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Seed banks as a partnership for global plant conservation

Semenske banke kot oblika partnerstva za globalno varovanje rastlinskih vrst

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Abstract: A seed bank is a collection of plant seeds stored under appropriate conditions in which seeds are periodically checked for their germination ability – viability of seeds. Botanic gardens have been issuing lists of seeds (*Index seminum*) for several centuries. This old tradition has also encouraged the formation of botanic gardens seed banks. University Botanic Gardens Ljubljana actively works on plant diversity conservation. In 2013, the Garden participated in the collection of seeds for the Millennium Seed Bank in order to contribute to a faster achievement of the goal of seed banking of 25 % of the total world flora. For this reason, in 2013, seeds of 59 target plant species of Slovenian flora (already selected before for routine collection) and seeds of 24 other randomly selected plant species for the Millennium Seed Bank were collected.

Keywords: seed bank, *ex-situ* conservation, *in-situ* conservation, Slovenia, endangered plants

Izvleček: Semenska banka je zbirka rastlinskih semen, ki so shranjena pod specifičnimi pogoji. V njej se periodično preverja njihova sposobnost kaljivosti – živost semen. Botanični vrtovi so sezname semen (*Index seminum)* izdajali že vrsto stoletij. Ta dolga tradicija je botanične vrtove vzpodbudila k ustanavljanju lastnih semenskih bank. Tudi Botanični vrt Univerze v Ljubljani aktivno sodeluje pri varovanju rastlinske pestrosti. V letu 2013 je Botanični vrt prispeval semena v Milenijsko semensko banko, z namenom čim prej doseči cilj, katerega namen je zbrati semena 25 % rastlin svetovne flore. Zaradi tega razloga smo v letu 2013 za Milenijsko semensko banko nabrali semena 59 ciljnih vrst (že vnaprej določenih) in semena 24 naključno nabranih rastlinskih vrst slovenske flore.

Ključne besede: semenska banka, *ex-situ* varstvo, *in-situ* varstvo, Slovenija, ogrožene rastlinske vrste

Introduction

A seed bank is a collection of plant seeds stored under appropriate conditions in which seeds are periodically checked for their germination ability – viability of seeds. Natural seed banks are a viable seed reservoir present in soil (Roberts 1981). However, seed banks are much more than seed

storage. They also play the role of gene banks, which is a broader concept and encompasses *ex-situ* conservation of seeds as well as pollen, other germplasm, such as as in vitro culture and whole plants grown in the cultures. It requires storage under appropriate conditions enabling the preservation of viability for a longer period. A seed bank is thus only a part of the broader concept of gene banks. Seeds banks are one of the ways to preserve species outside their natural habitat. As suggested by the Global Strategy for Plant Conservation, seed banks are the most useful method for off-site, or *ex-situ*, conservation of wild plants. Seeds are compact, dormant germplasm packages, which can be easily stored (Guerrant and McMahan 1997).

For several centuries, botanic gardens have been issuing lists of seeds for exchange (*Index seminum*). It is an old tradition and this has also encouraged the establishment of botanic gardens seed banks (Heywood 1964, Bavcon 2009). Botanic gardens started with the seed exchange quite early. Seed exchange based on a seed index presumably started in 1648, when Jacob Bobart compiled the first index of seeds collected in the Oxford Botanic Garden. According to Aplin et al. (2007) this was considered to be the first printed seed index, even though a 1614 manuscript of the "*Semina Horti Medici*" from the Botanic Garden Padova (Orto botanico di Padova) exists (Cappelleti and Ongaro 2008). The seed exchange between gardens has a long tradition (Bavcon 2009, 2012), while seed banks started in 1920s for crop plants. For native plants seed banks were organized 50 years later. For wild plants seed dormancy still creates some problems. Seed dormancy is not a new phenomenon and was discovered by Kerner (1894). Nowadays, seed banks with their specific storage conditions are one of the most cost-effective methods of providing resources for long-term *ex-situ* conservation of genetic material of plants. Long- term storage techniques were first developed for crop plants by different organizations: the International Plant Genetic Resources Institute (IPGRI), previously the International Board of Plant Genetic Resources (IBPGR), and the Food and Agricultural Organization of the United Nations (FAO). The main advantage of seed banking is that it allows large populations to be preserved and minimizes genetic erosion by providing optimum conditions and reducing the need for regeneration (Laliberte 1997, Given 1987). In Spain a seed bank for wild plants (UPM) was established in 1966 at the Polytechnic University of Madrid. It was the pioneer seed bank for wild plant species with the aim of a long-term *ex-situ* conservation of wild taxa and supply of seed material for basic or applied research (Gomez and Campo 1997). The beginning of the seed bank in Royal Botanic Gardens Kew dates back to late 1960s in the Kew's Living Collections Division to support the annual exchange of plant material among botanic gardens. With the aim of *ex-situ* conservation of wild flora some partnerships were established as well as some international cooperation initiatives, such as Ensconet project. On the national level, collaboration to the same aim was also established, such as Ribes in Italy (Rossi et al. 2012). There were also plenty of regional initiatives with the aim to collect and store the seeds of the regional flora (Tinti et al. 2012, Civiale et al. 2012, Magrini et al. 2012, Rossi and Mandoni 2012, Zappa et al. 2012, Aztzeri et al. 2012). To help the Global Strategy for Plant Conservation, different activities on the international (Wyse Jackson 2011) and national level were started (Kiehn and Berg 2011, Puchalski et al. 2011).

One of the most comprehensive and expensive conservation projects in the field is the Millenium Seed Bank Project, launched by the Royal Botanic Kew Gardens in the UK in 2000. The motivation for the Millenium Seed Bank Project is the need to protect the increasingly endangered plant species in the natural habitat. By storing seeds, a greater number of specimens of a single species can be stored, which helps to preserve its natural diversity. The goal of the project is very ambitious. In 2010, the Millenium Seed Bank collected seeds from flowering plants from the whole England and 10% of the seed material from all over the world, with a special focus on plants from dry tropical regions. By 2020 their goal is to collect as much as 25% of the seed material of the world flora. The bank receives seeds mostly from similar institutions abroad, donations and, above all, partnerships with local botanists. The goal of this immense undertaking is to collect and safely store seed material in order to preserve plant species for research purposes and repopulation of the species in their natural habitats. A special importance is devoted to the endangered species that are facing

a population decline or extinction, focusing not only on economically important plants, but also on other ones.

University Botanic Gardens Ljubljana actively works on plant diversity conservation. Besides plants and seed collecting in the wild, they grow them in *ex-situ* conditions. There is also a project of *in-situ* plant conservation on a natural dry meadow in the surroundings of the capital city Ljubljana (Bavcon and Marinček 2004, Bavcon 2008, 2010a, b). It includes reintroduction purposes. A more recent case of successful reintroduction is the reintroduction of *Pastinaca sativa* var. *fleischmanni* L. (Hladnik) Burnat to its original location at the Ljubljana castle in 2011 (Bavcon 2013).

Due to the excellent seed storage facilities at the Millenium Seed Bank, University Botanic Gardens Ljubljana has collected and donated seeds of some Slovenian indigenous plant species. Apart from the long tradition of seed collection and plant species protection in our own seed bank, our seeds are now stored in a much more elaborate institution which will facilitate the reintroduction of any of the preserved plants in case of extinction or endangerment in their natural habitat.

Material and methods

Sampling site description

Collection sites were chosen on the basis of our past knowledge about the distribution of plant species. For seed collection, only locations with big population of target species were chosen, which was performed in 37 different locations (Figure 1). Area size for seeds collection ranged between 50 m^2 and 500 m^2. According to M. Wraber (1969), Slovenia can be divided into six phytogeographic regions, of which the majority of our locations for seed collection was located in the Submediterranean and the Dinaric phytogeographic regions. Habitat types of the collected plants were very diverse, ranging from grasslands to forest edges. Only a few of the collection locations were in the Dinaric beech forest.

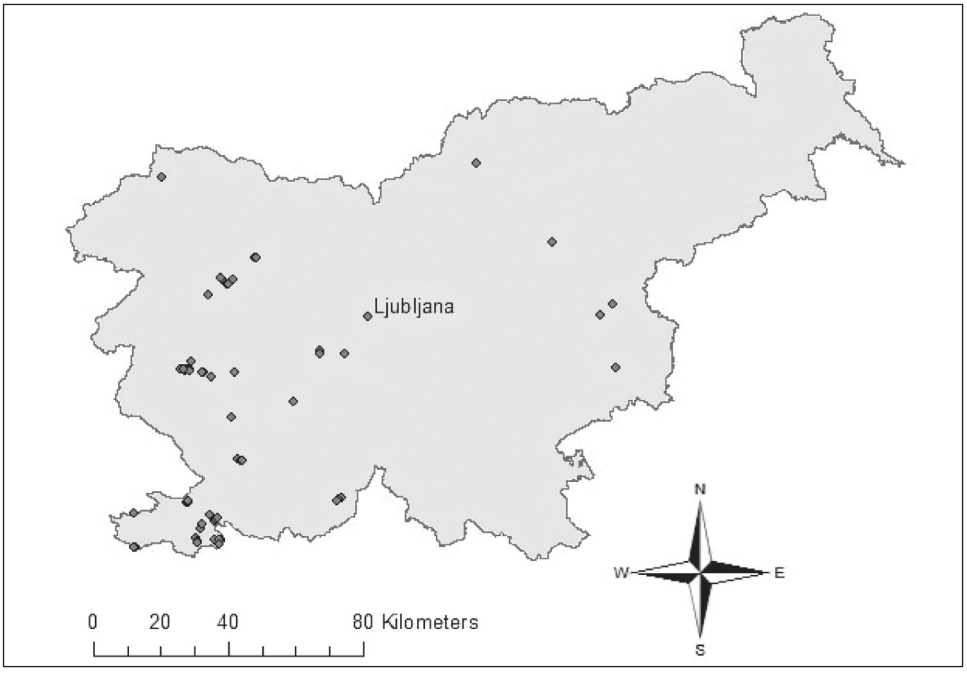

Figure 1: Map of localities in Slovenia where seeds were collected (the number of locality points on the map is smaller than in the reality because some localities are very close to each other)

Slika 1: Zemljevid Slovenije z lokalitetami kjer smo nabirali semena (število točk z označenimi lokacijami je manjše kot v resnici, saj so nekatere lokacije zelo blizu skupaj)

Field work

In 2012, before the seed-collecting season, we prepared the target species list, which was then accepted by the Millenium Seed Bank. Our plant selection was based on the following criteria: all chosen plants species are native, some of them are endemic, endangered or vulnerable, truly representing the Slovenian flora. The key factor for selecting the target plant species, the seeds of which we wanted to use for collaborative project with the MSB, was mainly its conservation status on the local and global scale (Wraber and Skoberne 1989, Official Gazette RS, No. 82/2002). Plant seeds for the Millenium Seed Bank were collected in 2013. Due to a rather long winter and consequently late fruiting of plants in spring, we started field work in May and continued until December. Every month we had to carry out one or more days of field work. All locations with target species were first visited in the blooming season in order to collect a flowering plant of every target species as herbarium specimens. The seeds were collected on a day with favourable weather (without rainfall and without heavy wind). We never collected seeds after rain because this prolongs the drying phase and increases the risk of fungi infections. Seeds were always collected from as big as possible plant populations. When collecting the seeds, proper identification of plant species and seed maturity was performed. Seeds of each plant species were collected into a separate bag, labelled accordingly with plant species name, location and collection date. All collected seeds were taken to the botanic garden and were desiccated to the proper level of moisture content. In the Garden we used a traditional way of curing in the air, leaving the seeds on the stems in a dry place at room temperature to fall of the fruit on their own. Depending on the species, this lasted from late spring to late autumn through winter when the seeds were cleaned by hand. The cleaned seeds were then packed into paper and cotton bags, labelled with species name, identification number, locality and date of collection. When collecting seeds for each location and for each species, the collection forms were filled out according to the MSB collection protocol (Figure 2). A certain amount of seeds from each species collected was also stored in our own seed bank. All plant species were prepared to be inserted into herbarium. Herbarium sheets were appropriately labelled with the basic information about the plant (plant name, collector, collecting date, state). Seeds and herbarium sheets were then shipped to the Millenium Seed Bank in England.

Results

In 2013 we collected seeds of 59 target plant species of the Slovenian native flora (pre-selected for collection) and seeds of 24 other randomly selected plant species for the Millennium Seed Bank. Among the target plant species the only species we could not collect seeds from is *Allium victorialis* L., which did not bloom that year. The rest comprise three Slovenian endemic species, thirteen protected species, eight vulnerable species, one rare species and one species with an under-researched conservation status. We carried out 44 days of field work of seeds collection on 37 localities with additional 10 days needed for observation of phenological phases of the target species. For most species we were able to collect the required quantity of seeds. The only exceptions were the following species: *Arabis sagittata* (Bertol.) DC., *Cortusa matthioli* L., *Eryngium alpinum* L., *Lonicera alpigena* L. and *Primula carniolica* Jacq.

The seeds of the selected plant species were collected in six different phytogeographical regions where the seeds of the majority of the species (45) were collected in the Submediterranean phytogeographical region while the rest were collected in the Alpine phytogeographical region (Table 1). Seed collection started in May and lasted until December. Seeds of the majority of the species were collected in September (27) and June (25). These were mostly late-spring blooming species in lower altitudes and early-spring blooming species in higher altitudes, which were under snow for a long time in 2013. Seeds of the least number of species, mostly summer and autumn blooming, were collected in November (7) and December (1). We were able to collect the seeds of some species from early summer until late autumn due to their after-blooming.

Appendix 1 Passport (Collecting) Data Form

FIELDS IN GREY ARE MANDATORY

Accession ID					**Collection Number** *(same as bag number)*	
Collection date		YYYY	MM	DD		
Main Collector Surname & First Name *(CAPITALS)*					**Institution**	
Other collectors Names and Institutions						
Taxon name						
Vernacular name(s) (+ language)						
Herbarium Voucher	Yes/No Number:	**Number of mature plants found** (tick one)	1..... 2-5..... 5-10..... 10-25.... 25-50.... 50-100.. 100-1000..... 1000+...	**Number of plants sampled** (tick one)	1..... 2-5..... 5-10..... 10-25.... 25-50.... 50-100.. 100-1000..... 1000+...	**Phenology status** *(tick one)*
Soil sample	Yes/No Number:					More flowers than fruits..... More fruits than flowers..... Only fruits..... Fruits already dispersed.....
Sampling Method *(tick one)*	Random..... Regular..... Transect (linear).... Core of population. Edge of population. Other.....					
Sampling area visited (m x m)				**Seeds / fruits collected from ground?** YES NO Partially		
Photos *(give references)*						
Country		**Primary subdivision**				
Secondary subdivision *(council, municipality…)*						
Locality						
Latitude Y		**Longitude X**		**Units** (tick one)	Degrees Meters	**EPSG Code** (see codes)
Altitude (m)		**Water depth** (aquatics) (m)				**Altitude Accuracy** (m)

Geocode provided by collector?	**Geocode Method** *(tick one)*	**Altitude Method** *(tick one)*	**Prevalent Aspect** *(tick one)*	**Slope** *(tick one)*	**Soil texture** *(tick one)*	**Soil pH** *(tick one)*
Yes	GPS	Altimeter	N	Level 0-5%	Gravel	Acidic
No	DGPS	DEM	N-E	Undulating 6-10%	Sand	Alkaline
	Estimate	GPS	E	Rolling 11-20%	Sandy loam	Neutral
	Map	Estimate	S-E	Moderate 21-31%	Loam	
	Google Earth	Map	S	Steep >30%	Clay loam	
			S-W		Clay	
			W		Peat	
			N-W		No soil	

EUNIS Habitat Code *(see codes)*	**Land Use Code** *(see codes)*	**Threats**
Site Notes (observations or any relevant information)		
Associated species (SPECIFY 3-5 rare or abundant species)		
Collecting Notes (e.g. problems encountered, collecting method, estimate of seed nos., flower colour etc)		

Figure 2: Scan of the seed collecting protocol made by Milennium Seed Bank
Slika 2: Kopija protokola za nabiranje semen, izdelanega s strani Milenijske semenske banke

Table 1: List of the collected species per phytogeographical region (1-alpine, 2-subalpine, 3-dinaric, 4-subdinaric, 5-submediterranean, 6-subpannonian) and their conservation status
Table 1: Seznam nabranih semen v posamezni fitogeografski regiji (1-alpska, 2-predalpska, 3-dinarska, 4-predinarska, 5-submediteranska, 6-subpanonska)

	Status	1	2	3	4	5	6
Abies alba Mill.	least			*			
Aconitum variegatum L.				*			
Allium senescens L.				*		*	
Anthericum ramosum L.				*		*	
Arabis sagittata (Bertol.) DC.				*		*	
Arabis turrita L.				*		*	
Asphodelus albus Mill.	vulnerable					*	
Briza media L.					*		
Caltha palustris L.			*				
Centaurea rupestris L.				*		*	
Cirsium pannonicum Link			*			*	
Colchicum autumnale L.						*	
Coronilla emerus L. subsp. *emeroides* Boiss. & Spruner						*	
Cortusa matthioli L.	rare	*					
Cotinus coggygria Scop.						*	
Crithmum maritimum L.						*	
Dentaria enneaphyllos L.			*				
Dianthus tergestinus Rchb.	protected	*				*	
Dictamnus albus L.						*	
Dryas octopetala L.		*		*			
Echinops ritro L. subsp. *ruthenicus* (Bieb.) Nyman.				*		*	
Epimedium alpinum L.					*		
Eranthis hyemalis Salisb.	protected						*
Eriophorum angustifolium Roth	vulnerable					*	
Eriophorum latifolium Hoppe	vulnerable					*	
Eryngium alpinum L.	protected			*			
Eryngium amethystinum L.						*	
Fritillaria meleagris L.	protected		*				
Gentiana asclepiadea L.			*				
Gentiana clusii E. P. Perrier & Songeon	protected			*			
Gentiana lutea L. subsp. *symphyandra* Murbeck	vulnerable					*	
Gentiana pannonica Scop.	protected			*			
Gladiolus illyricus W. D. J. Koch	vulnerable		*				
Globularia punctata Lapeyr.					*	*	
Grafia golaka (Hacq.) Rchb.				*			
Hacquetia epipactis DC.			*				
Hladnikia pastinacifolia Rchb.	endemic			*			
Homogyne alpina Cass.		*					
Hypochoeris maculata L.							*
Hyssopus officinalis L.						*	
Inula ensifolia L.						*	
Inula hirta L.				*		*	
Iris sibirica L. subsp. *erirrhiza* (Pospichal) T. Wraber	endemic					*	
Juniperus communis L.						*	
Jurinea mollis Rchb.						*	
Laserpitium siler L.				*			
Leontopodium alpinum Cass.	protected			*			

Leucojum aestivum L.	vulnerable		*	*			
Leucojum vernum L.		*					*
Libanotis sibirica W. D. J. Koch					*		
Ligusticum seguieri Vill.			*				
Lilium carniolicum Bernh.	protected				*		
Linum narbonense L.			*		*		
Lonicera alpigena L.			*				
Lychnis flos-cuculi L.			*				
Marrubium incanum Desr.					*		
Narcissus poeticus L. subsp. *radiiflorus* (Salisb.) Baker	vulnerable				*		
Paeonia officinalis L.	vulnerable				*		
Petasites albus Gaertn.		*					
Petasites hybridus (L.) G. Gaertn., B. Mey. & Scherb.			*				
Primula auricula L.			*				
Primula carniolica Jacq.	endemic	*					
Pulsatilla montana Rchb.	protected				*		
Pulsatilla nigricans Storck	protected			*			
Rosa glauca Pourr.			*				
Rosa pendulina L.			*				
Ruscus aculeatus L.	protected				*		
Ruta divaricata Ten.			*		*		
Salvia pratensis L.					*	*	
Satureja montana L.					*		
Satureja subspicata Bartl. ex Vis. subsp. *liburnica* Šilić					*		
Scabiosa graminifolia L.			*				
Scopolia carniolica Jacq.		*					
Smyrnium perfoliatum L.					*		
Stipa eriocaulis Borb.	protected				*		
Thalictrum aquilegiifolium L.			*		*		
Thalictrum minus L.					*		
Tragopogon dubius Scop.					*		
Trifolium rubens L.	lack of knowledge				*		
Trollius europaeus L.		*					
Veratrum album L. subsp. *lobelianum* (Bernh. in Schrader) Suessenguth			*				
Veratrum nigrum L.	vulnerable		*				

Discussion

The University Botanic Gardens Ljubljana has a long tradition of seed collecting for its own seed bank and for exchange through the *Index seminum*. Each year we try to collect the seeds from as many plant species as possible, in the garden or in the wild. Each year, we try to regenerate the seed stock of the endangered species or the species of special importance for Slovenian flora. In case of a drastic reduction of populations of a certain plant species the seeds stored in our seed bank enable us to reintroduce the species and in this way contribute to conservation of plant diversity. A successful reintroduction was carried out for the *Degenia velebitica* (Deg.) Hay. (Strgar 1979) already in the 70's and early 80's of the last century in the Botanic Garden of University in Ljubljana. We were therefore pleased to accept the possibility to participate the seed collection campaign for the Millennium seed bank in order to contribute to a faster achievement of the goal to collect seeds for 25 % of the total world flora. At the same time, this is a good opportunity for the seeds of the rich

Slovenian flora to be stored in such a superior seed bank as the Millennium Seed Bank and introduce the reach biodiversity beyond Slovenia. The key factor for selecting the target plant species was mainly their conservation status at the local and global level. We have therefore selected the target species that are especially important for Slovenia. Among them were native plant species, having their *locus classicus* in Slovenia or endemic for this or the neighbouring region (Scopoli 1772, Host 1827-1831, Mayer 1960, Zupančič and Wraber 1996). On the basis of various conventions, these species should be especially protected near their origin.

In 2013, seed collection started only in May because of long winter and wet weather in early spring. Bad weather conditions caused a late onset of spring and consequently also a delay in blooming as well as fruiting of many plant species. Another problem for seed collection in spring time was the expansion of snail populations which arose due to high humidity and precipitation, eating fruits of many spring plant species, like the *Leucojum vernum* L.. We also noticed that many spring species did not develop fruits and seeds at all, although the left-overs of flowers were seen (e.g. *Cortusa matthioli* L.). The reason for this could be the absence of pollinators, because at the time of blooming either the temperatures were to low for most pollinators, or precipitations very frequent, decreasing the number of pollinators even further. These phenomena were observed for *Scopolia carniolica* Jacq. on a sampling site near Kamnik. The whole plant population was without fruits, while at higher altitude localities, where the plants were blooming later in spring, we were able to collect them. We also tried to collect seeds of its yellow flowering forma (*Scopolia carniolica* Jacq. f. *hladnikiana* (Biatz. & Fleischm.) near Kamnik, but because of unforeseeable weather conditions, unexpected cold spells and late snowing, we could not find any flowering specimens. Therefore we could not mark the populations and separate them from the original brown-flowering species. Different animals were the reason of fruit absence for some other plant species as well. The fruits of *Iris sibirica* L. subsp. *erirrhiza* (Pospichal) T. Wraber and *Paeonia officinalis* L. subsp. *officinalis* were eaten by deer and flowers of *Eryngium alpinum* L. were consumed by sheep. This could be a consequence of extreme draught. In hot and dry periods, animals namely look for every juicy plant part. Drought in the last couple of years and high temperatures also thinned local population of *Leontopodium alpinum* Cass. in Trnovski gozd. Hardly any flowering or fruiting plants were seen although the population was quite large. Therefore we collected these seeds at the top of Mt. Snežnik.

During field work we noticed that natural populations of some plant species are affected by overgrowing, such as the *locus classicus* population of *Gentiana pannonica* Scop. on the hill of Porezen. Its population was reduced for several years due to omission of mowing in the 1970s (Seljak 2002, Bavcon 2008). However, overgrazing has had an even worse effect on its distribution, which is why populations could not increase. In this place, only 20-54 plants flower each year. The entire population consists of about 100 plants which do not all flower in the same year. Measures should be taken to use grassland in this area in a proper way again and so prevent overgrowing with trees, tall herbs and shrubs (Bavcon 2008). The same has happened to *Eryngium alpinum* L., on the Porezen hill where species became endangered due to abandonement of pastures and overgrowing in 1980s (Seljak 2002). With pasture restoration they are now spreading again (Bavcon 2008, Bavcon 2013). If areas are not be left to occasional pasture, the species will sooner or later be threatened with extinction.

Another problem that can affect many grassland species is inappropriate landscape management, like early mowing and intensive agriculture. Populations of *Fritilaria meleagris* L. at the Ljubljana moor are decreasing because of fertilizer use and early spring mowing (Bavcon 2010a). As a result, the plants do not finish blooming and can reproduce only vegetatively by bulb division. The population decline because of early mowing is also notable for species like *Gladiolus illyricus* Koch., *Cirsium pannonicum* Link. and *Linum viscosum* L.. Therefore all those species are protected *in-situ* on a dry meadow near the Sava river by the University Botanic Garden Ljubljana (Bavcon 2008, 2010a).

However, we were positively surprised by the population increase for the endemic species *Primula carniolica* Jacq. This is the species the distribution of which has been increasing in the last decades (Wraber 1990). Population size is

now big enough everywhere. Even grazing did not decrease its populations. On its natural sites which were discovered in 1980s (Bavcon 1987, Bavcon and Terpin 1991), there are still many plants despite pasture. Their dispersion is even larger than before.

Despite a long winter and rainy spring in 2013 we were able to collect the seeds of Slovenian endemics and protected plant species as required by the collecting standards of the Millennium Seed Bank. Field work within this project has also given us a possibility to monitor the populations of some plant species and to predict solutions for its conservation.

Povzetek

Semenska banka je zbirka semen rastlin, skladiščenih pod ustreznimi pogoji, kjer se občasno preverja kalivost – živost semen. Naravna semenska banka je skupek semen, shranjenih v tleh. V sodobni semenski banki pa morajo biti semena skladiščena pod ustreznimi pogoji, kar omogoča ohranjanje živosti za daljše obdobje. Za vsako vrsto je potrebno izdelati protokol hranjenja, preverjanja kalivosti in obnavljanja zalog. Semenske banke so eden izmed načinov ohranitve vrst izven naravnih razmer, kar imenujemo tudi *ex-situ* varstvo rastlinskih vrst. V botaničnih vrtovih je izdajanje seznamov semen (*Index seminum*) že nekaj stoletij stara tradicija in prav to je tudi vzpodbudilo nastanek semenskih bank botaničnih vrtov, ki pa so relativno nove. Prve so se začele pojavljati v šestdesetih letih prejšnjega stoletja. V tem času je tudi botanični vrt Kew Garden začel s prvimi zametki semenske banke, ki je do leta 2000 prerasla v milenijsko semensko banko. Tedaj so odprli povsem nov kompleks v podružnici botaničnega vrta Kew Gardens v kraju Wakehurst. Njen cilj je bil do leta 2010 zbrati 10 % svetovne flore, do leta 2020 pa so si za cilj zadali zbrati 25 % svetovne flore. V ta namen botanični vrt Kew Gardens išče ustrezne partnerje v različnih delih sveta. Botanični vrt Univerze v Ljubljani je leta 2013 dobil možnost sodelovanja pri tem projektu. V ta namen smo najprej pripravili listo semen rastlin, ki so jih v botaničnem vrtu Kew Gardens pregledali, ocenili in potrdili. Spomladi smo začeli s terenskim delom. Cilj milenijske semenske banke je, da polovica materiala ostane v matični inštituciji, polovica materiala pa gre v milenijsko semensko banko. Za vsako vrsto je bilo potrebno napisati protokol, nabrati herbarijski material in minimalno število semen, kar pomeni vsaj 500 semen, zaželjeno število pa je 5000 semen. V toku ene sezone smo zbrali semena 59 vrst iz potrjene liste in še 24 dodatnih. Semena smo nabirali od maja do decembra v vseh fitogeografskih območjih Slovenije. Zaradi vremenskih razmer, pozne zime in velike namočenosti tal ter hladne pomladi, mnoge vrste niso tako obilno semenile kot v prejšnjih letih, na nekaterih delih pa semen sploh ni bilo. V poletnem času so bile problem izredno visoke temperature in s tem povezana suša, kar je produkcijo semen pri nekaterih vrstah zopet zmanjšalo. Kljub temu smo uspeli zbrati semena vseh vrst, le bistveno več terenskega dela je bilo potrebnega. Semena so sedaj shranjena v milenijski semenski banki botaničnega vrta Kew Gardens in v Botaničnem vrtu Univerze v Ljubljani. Z omenjenim projektom se je potrdilo sodelovanje s to elitno ustanovo, ki je že leta 1889 naročila prva semena iz Botaničnega vrta v Ljubljani na osnovi tedaj prvič natisnjene publikacije *Index seminum*, ki izhaja vse do današnjih dni.

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