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**european botanic  
gardens congress  
2022**

**BOOK OF ABSTRACTS**

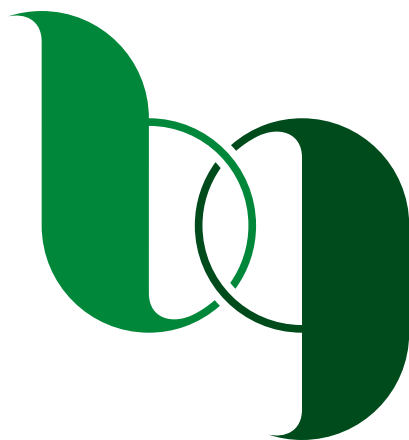


## European botanic gardens congress

16-20 May 2022, Budapest

botanic gardens – where people and plants meet





# europaean botanic gardens congress

16–20 May 2022, Budapest

*botanic gardens –  
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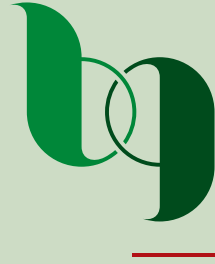
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# ORAL PRESENTATIONS

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in alphabetic order  
of the first authors



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## DESIGNING EDUCATIONAL OFFER FOR CHILDREN WITH CHILDREN - THE CASE OF THE NEW INTERPRETATION SYSTEM AT THE UNIVERSITY OF WARSAW BOTANIC GARDEN

**Anna ALBIN, Magdalena OPRZADEK**

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Co-creation in design is becoming increasingly common, also among botanic gardens. However, participants of such projects are most often adults, not children. Families with children and school groups are two major groups that visit the University of Warsaw Botanic Garden. While the school groups most often book guided tours, we realized that the Garden lacks a proper interpretation system directed to small children that visit us with their families, without an educator. We decided that children themselves will be the best advisors on how would such an interpretation system look like. In September 2020 we conducted a participatory project called "InfOgrodek" to determine how children would like to spend time in the Garden, what topics and activities are interesting to them, what and how would they like to learn. We invited a home-schooling group from Warsaw, with 14 children aged between 3 and 10, who spent a week with us, exploring the garden and actively participating in the design process. During InfOgrodek we applied methods that allowed children to critically examine the garden, think about different possibilities and make choices. The children's parents also took an active part in the design process. The project ended with a list of recommendations for children-friendly education that are possible to implement.

The presentation will show the process, applied methods, the results and reflections for future implementation.

• **Keywords:** *children, education, design, interpretation*





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## **BOTANIC GARDEN “D. BRANDZA” – OVER 160 YEARS DEVOTED TO EDUCATION, RESEARCH AND PLANTS CONSERVATION**

**Paulina ANASTASIU**

*University of Bucharest, Botanic Garden D. Brandza, Bucharest, Romania*

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The story of the Botanic Garden in Bucharest begins over 160 years ago, when Carol Davila conceived the Garden as a place for his students at the University of Medicine to perfect their knowledge about medicinal plants. 14 years after its founding, the Garden was moved under the leadership of the University of Bucharest. Over the decades the Botanic Garden has grown to be much more than a collection of exotic and native plants. It is a space for academic teaching and research, conservation, education, and public engagement.

Through our research we seek to better understand plant diversity in the different regions of our country, and the challenges plants face due to climate change, biological invasions, and other factors. One of our key programmes investigates the impact of climate change on plants and their habitats in mountain and alpine area. Another significant programme is focused on the management of alien invasive species in order to identify efficient strategies to prevent, limit or eliminate invasive alien plants that pose a threat to native ones and to natural or semi-natural habitats.

We also offer educational programmes for all ages, with a focus on fostering better knowledge, more love and respect for nature. As an academic institution, we host for university students practical work sessions, courses, teaching visits, and opportunities for research work. Our learning programmes draw on a collection of live plants of over 3.500 species, as well as a collection of herbarium of over 520.000 specimens. For children we developed the programme The Little Botanist, which includes classes, creative workshops, and practical activities. Moreover, to support our educational activities, we have set up new sectors such as Grandmother's Garden or Historical Garden.

We are always seeking new ways to bring people closer to nature. For our community of plant-lovers we regularly host events that highlight the importance of biodiversity and the urgent need to protect it.

• **Keywords:** *historic garden, infrastructure, research programmes, environmental education*



## EUROPEAN PROGRESS TOWARDS THE GLOBAL STRATEGY FOR PLANT CONSERVATION 2011-2020: REVIEW IN A NUTSHELL

**Philippe BARDIN**

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The aim of the speech is to shed light on key points of European progress towards the second release of the Global Strategy for Plant Conservation.

The European Strategy consists on a set of 5 main objectives that are divided into sub-targets.

- Plant diversity is well understood, documented and recognized.
- Plant diversity is conserved
- Plant diversity is used in a sustainable manner.
- Education and awareness.
- The development of capacities and public engagement.

These Targets and sub-targets of the European Strategy are fully aligned with those of the Global Strategy. The European Strategy have been promoted by the Bern Convention Secretariat at the Council of Europe.

The authors of the review, on behalf of PLANTA EUROPA and PLANTLIFE INTERNATIONAL who have implemented the European Strategy over the last two decades, used data of the CBD 6<sup>th</sup> National reports that have been released in 2019, and more specifically the Section V of these reports focusing on the "Achievement of the Targets of the GSPC".

The speech draws a comparison between the level of achievement of the Global and European Strategy for Plant Conservation and delivers a global overview of what remains to do to better complete the targets of the Strategies. The speech also focuses on several regional outstanding contributions that would inspire and feed the upcoming international Agendas for Biodiversity.

PLANTA EUROPA is willing to link its forthcoming action plan or the new European Strategy to International Bodies schedules. For that purpose, PLANTA EUROPA has been involved in the drafting of the new Vision and Strategic Plan of the Bern Convention for the period to 2030. The Convention's Strategic Plan would give a relevant framework to undertake concrete actions that Botanic Gardens could implement through their walls.

• **Keywords:** *European progress, GSPC, Planta Europa*



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## COLLECTIONS OF ORNAMENTAL PLANTS AS CULTURAL HERITAGE

**Alexandra BAUMEYER**

*Merian Gärten, Education & communication, Basel, Switzerland*

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The Merian Gärten in Basel, Switzerland, are internationally renowned for their large collections of ornamental plants. The collections hold not only species and natural varieties, but focus on cultivars that have shaped the history of ornamental plants. The Iris collection in particular is well known, as it holds more than 1500 cultivars of Tall Bearded Iris, many of these historic and no longer available on the market. Each plant has a story to tell, many surprising and touching, each illuminating an aspect of the development of horticulture and the work of influential breeders of the era. For those who understand the context, these collections can clearly be seen as cultural heritage.

However, to the public, the plant collections are mostly appreciated only on the level of "pretty flowers". Botanical gardens struggle to be accepted as cultural players, and are generally not seen to be in the same league as museums, the significance of their collections being easily overlooked.

In the Merian Gärten, considerable effort has been placed in recent times on how to create the necessary awareness and appreciation (of more than just the aesthetic) needed to understand botanical gardens as perpetuators of cultural heritage.

In this case study, we will present how the Merian Gärten have approached this, including following main aspects:

- in the recent redesign of a third of the gardens, each collection has been given an improved presentation that should help in emphasizing its importance
- stories within the collections have been researched and brought to light, making them available to the public in form of texts and guided tours
- specific communication messages are implemented on different levels and channels such as website, press, and other
- the greenhouses have been made accessible to the public to make visible the work involved beyond the obvious, including the role of a botanical garden in international horticultural networks.

• **Keywords:** *Collections, ornamental plants, cultivars, cultural heritage, visitors, public awareness, education, communication*



## DIVERSITY OF PRIMROSES IN SLOVENIA

**Jože BAVCON<sup>1</sup>, Branko VREŠ<sup>2</sup>, Blanka RAVNJAK<sup>1</sup>**

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Primroses (*Primula L.*) are a genus that is very commonly used in horticulture and is one of the most popular genera. As early as the 16<sup>th</sup> century, hybrids of species *Primula auricula L.* and *Primula hirsuta All.* were cultivated in gardens. Primroses are popular for gardeners and horticulture as well as botanists and botany as a science. The genus of primroses is widespread and distributed throughout the northern hemisphere. Quite a few of them are also growing in Slovenia. Despite the small size of the territory, 10 species and 6 hybrids have been recorded in Slovenia. Among the described species, the species *Primula carniolica* is endemic with a very small range within the country. Also endemic are the hybrids *Primula x venusta* Host (Idrija primrose) and *Primula x deschmannii* Ingw. Natural inter-species hybrids are very common in the *Primula* genus and we are constantly studying the occurrence of hybrids between individual species and their variability. Among the hybrids growing in Slovenia, *P. x venusta* stands out with its extraordinary variability, which is a hybrid between *P. carniolica* and *P. auricula*. It is present in very small numbers and only where the populations of both parent species come into contact and when their simultaneous flowering occurs. Due to its rarity, it has always been the subject of study and protection by the University Botanic Gardens Ljubljana. Although hybrids are usually infertile we studied seed germination of *P. venusta*. We have sown the seeds of hybrids in the University Botanic Gardens Ljubljana several times, but only ones in 2007 the seeds starts to germinate. We also regularly monitor the viability of its population in natural habitats.

• **Keywords:** *diversity, genus Primula, endemic, primroses hybrids*



## GLOBAL TREE PORTAL: THE FIRST CONSERVATION DATABASE FOR TREES

**Emily BEECH<sup>1</sup>, Malin RIVERS<sup>1</sup>, Ryan HILLS<sup>1</sup>, Stefan JÄNICKE<sup>2</sup>**

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The GlobalTree Portal, hosted by Botanic Gardens Conservation International (BGCI), is the first online portal bringing together information on the distribution, conservation status (global and others) and conservation actions for all the world's nearly 60,000 tree species.

The information in the portal is gathered as part of the Global Tree Assessment, a project to assess the conservation status of the world's tree species. The initial results of this project were published in September 2021 in the State of the World's Trees report, alongside the GlobalTree Portal. It revealed that 30% of all tree species are threatened with extinction. Although, over two-thirds of tree species are found in at least one protected area and about a third are found in ex situ collections, there remain significant gaps. The GlobalTree Portal is therefore a vital source of information for conservation practitioners to prioritise action to prevent the extinction of any of the world's tree species.

The GlobalTree Portal displays tree conservation information on species, country or global levels. On a species level, the Conservation Action Tracker contains information on active conservation actions known for trees (i.e. in situ conservation, ex situ conservation, species recovery plans etc.). On a country level, summary information and checklists of tree species with information on their endemism and conservation status are available.

The GlobalTree Portal also links together BGCI's four databases for the first time, combining the list of tree species (GlobalTreeSearch), conservation assessments (ThreatSearch), ex situ collections and their locations (PlantSearch and GardenSearch).

It is clear that botanic gardens are key custodians of the world's tree species, with over 17,000 tree species found in collections. However, many threatened species are not recorded in a single collection or under any conservation action and the GlobalTree Portal provides the data needed to save threatened trees.

• **Keywords:** *trees; data; assessments; ex situ; collections; databases*



## LIFE SEEDFORCE: A NEW PROJECT FOCUSED ON PLANT TRANSLOCATION

**Costantino BONOMI**

*MUSE, Trento Science Museum, Italy, Botany Department, Trento, Italy*

Developing successful plant conservation projects is a challenging task and requires an inclusive and multi-disciplinary approach, putting together diverse expertise to address all critical issues for a successful outcome. An integrated in-situ and ex-situ approach can yield numerous benefits and offer opportunities to showcase to the public the actual plants that conservationists aim to protect, in order to build participation and support from the local community. As a case study the recently approved Life+ SEEDFORCE project will be illustrated (LIFE20 NAT/IT/001468 - Using SEED banks to restore and reinFORCE the endangered native plants of Italy and cross border regions). This project includes preparatory actions to assess the genetic make-up of the target species and populations, to analyse the current species climatic envelope and to project possible future scenarios, taking into account trophic dependencies in target species. The outcome of such preparatory actions will be used to prepare the propagation mix best adapted for each site to be use for plant translocation, either reintroduction or population reinforcement. Once identified, key threats will be removed or mitigated, the target populations will be reinforced or re-established in extinct sites. A series of engagement activities have been devised to gain public support and to involve farmers that in most cases can influence the long-term conservation of many plant species in secondary habitats.

• **Keywords:** *plant translocation, Natura2000, unfavorable conservation status*



## CREATING AND USING “QUALITY × QUANTITY” MODEL TO CALCULATE AESTHETIC VALUE OF HIP PRODUCING OUTDOOR ROSE CULTIVARS

**Gábor BORONKAY, Dóra FARKAS, Szilvia KISVARGA,  
András B. NEMÉNYI, László ORLÓCI**

*Hungarian University of Agriculture and Life Sciences (MATE), Institute of Landscape Architecture, Urban Planning and Garden Art, Budapest, Hungary*

A model has been created in Rose Garden Budatétény for estimating the ornamental value of outdoor rose cultivars in autumn, when hips (pseudo-fruits) give the decorativeness. A special model was needed, because assessing hundreds of cultivars at same time requires index type results and fast but non-destructive recording methods. This ornamental value of hips ( $OV_h$ ) is based on our “quantity index × quality index” model. In this case quantity index is hip production (proportion of bush surface covered by hips), and the quality is the conspicuousness of the hips (red content of the surface colour). Estimating the quantity index needs visual ranking (as measuring would be unacceptably slow), here 13 categories (0-6 with 0.5 steps) were used. However it needs corrections to express the real hip production more accurately. Regression analyses were used between calculated hip productions and category numbers in a smaller, representative sample. The hip production was calculated as “( $\pi \times \text{length} \times \text{with of hip}$ ) × number of hips) / bush surface”. Strong correlation ( $R^2 = 0.95$ ) was found, when the regression model was power type ( $Y_{\text{pow}} = 0.067 \times \text{class number}^{3.44}$ ). Therefore the best quantity index of the model is the  $Y_{\text{pow}}$ . For the quality index, hip samples of different ripeness were assessed by testers to grade the decorativeness of hips in 20-degree scale, and the colour of the same hips were measured also by spectrophotometer. Between the estimated decorativeness and the measured colour parameters, the best correlation ( $R^2 = 0.925$ ) was found at CIELAB  $a^*$  dimension of the hip surface colour. It means that CIELAB  $a^*$  is appropriate for quantity index. To create equal weighting indices, unity-based normalization  $(X - X_{\text{min}}) / (X_{\text{max}} - X_{\text{min}})$  was needed. Based on these calculations the new model of the ornamental value of the hip is “ $OV_h = \text{normalized}(0.067 \times \text{class number}^{3.44}) \times \text{normalized}(\text{CIELAB } a^*_h)$ ”. In 2017 for testing the model, 541 cultivars were evaluated, where *Rosa micrantha* Borrer ex Sm. ( $OV_h = 0.94$ ), ‘Fragezeichen’ ( $OV_h = 0.89$ ) and ‘Aprikola’ ( $OV_h = 0.68$ ) had the highest ornamental value.

• **Keywords:** *rose garden, hip, ornamental value, colorimetry*



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## DIVERSIFYING SCIENCE IN BOTANICAL GARDENS, EXAMPLES FROM HORTUS BOTANICUS LEIDEN

**Roderick BOUMAN**

*Hungarian University of Agriculture and Life Sciences (MATE), Institute of Landscape  
Architecture, Urban Planning and Garden Art, Budapest, Hungary*

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In a changing societal landscape, the role of botanical gardens has also undergone transformation and expansion from their original purpose. Botanical gardens are now a fundamental part of the bridge between science and society. Most gardens now have public communication programs as well as education at both university level and for primary and secondary school children.

The Hortus botanicus Leiden is part of Leiden University, but its original purpose as a place for medical students to learn about botany has significantly changed. As the garden grew, it also became a place for botanical research and to house plants that have now become part of the historical collections from the times of Boerhaave and Von Siebold. In recent years, the botanical garden has undergone new challenges, including the transfer of the herbarium to the natural history museum of Naturalis Biodiversity Center. While the Hortus botanicus Leiden houses a wonderful living collection with several specializations, we are dependent on the facilities of other departments and international collaborations for most of our research.

In recent years, we have expanded our areas of research to host experiments not only from plant sciences, but also entomology, archeology, and various citizen science projects. We currently have research projects on the evolution and ecology of various taxa, as well as studies on how to effectively enthuse the public for the wonders of plants both in and out of the garden. In this talk, I would like to present some of the experiments and developments carried out in the Hortus botanicus Leiden and our plans for the future. This way we wish to highlight and discuss the role of botanical gardens in the future and how we can improve our efforts as both a scientific and educational institute.

• **Keywords:** *citizen science, experiments, interdisciplinary research, living collections*





## PHENOLOGICAL OBSERVATIONS WITH SECONDARY SCHOOLS

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Barbara KNICKMANN<sup>1</sup>, Michael KIEHN<sup>2</sup>**

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<sup>2</sup>*Botanical Garden of the University of Vienna, Core Facility of Botanical Garden, Vienna, Austria*

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Phenological observations are of major importance for studying the effects of climate change. As a member of the PhenObs network, the Botanical Garden of the University of Vienna is involved in phenological observations of herbaceous plants. Apart from conducting on-site observations on our own, we also explored to what extent such observations can be conducted with students from secondary schools.

Our aim was to use phenological observations to raise awareness about effects of climate change in secondary schools. Moreover, we examined whether students aged between 13-16 years were able to collect valid data. To this end, we instructed students from nine different secondary schools across Austria how to make phenological observations on twelve different species of herbaceous plants. The schools were partners of makingAchange, a cooperation between schools and science institutions dedicated to induce societal change with regards to climate change. Due to Covid-19 restrictions training of the participants took place in online sessions. In addition, we created a manual that enabled teachers to instruct their students themselves. We also established an online forum to aid in the identification of plant species and phenological stages.

Our results show that students were able to identify the targeted plant species and to distinguish phenological stages in those species. However, there was a high amount of errors, indicating that the botanical skills of the target group were still limited despite of the training. Thus, much of the reported observations did not immediately fulfil scientific requirements.

We conclude that phenological observations are a viable tool for botanical gardens to engage school children with plants, to enhance their skills in observing plants and to raise awareness about the impacts of climate change. In order to collect scientifically valid data, however, extensive training and continuous support of pupils is needed.

• **Keywords:** *phenology, herbaceous plants, secondary schools, climate change*



## VIRTUAL VERSUS PHYSICAL DURING COVID-19 PANDEMIC - REFLECTIONS FROM THE EXPERIENCE OF THE BOTANIC GARDEN „D. BRANDZA” IN BUCHAREST

**Petronela CAMEN-COMANESCU, Maria RAICU, Eugenia NITA, Paulina ANASTASIU**

*University of Bucharest, Botanic Garden D. Brandza, Bucharest, Romania*

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The Botanic Garden „D. Brandza” of the University of Bucharest was fully closed to visitors for two months in 2020 due to the COVID-19 pandemic. This forced us to shift some of our work – in particular our educational and community engagement activities – online. Without much previous experience in online engagement, this was a challenging time for our team, but also one of adaptation, creativity and learning. As we emerge from the pandemic, we reflect on how this experience has shaped our plans for the future and how a greater online presence can strengthen our educational programmes.

The transition from physical to virtual activities presented some challenges: lack of digital technology, digital skills gaps in the workforce, lack of staff availability to develop and carry out new educational activities online. We did however recognise the need to respond to the shift to digital, and therefore focused our attention on improving our online presence. For example, we redesigned our website and offered more online resources, we increased our engagement with our supporters on our Facebook page and sought to reach out to new audiences by setting up an Instagram account.

In May 2020 the Garden was once again allowed to re-open, and we have been able to host a larger range of outdoor activities and events. We also sought to keep engagement with visitors high by hosting a greater number of activities than we used to host pre-pandemic. Thus, over the past 18 months we held a significant number of cultural events (exhibitions, music concerts), creative workshops and educational activities for children.

The Covid-19 lockdown in 2020, and the prospect of new lockdowns returning have highlighted to us the importance of having a strong and multifaceted online presence. While the core of our activities will continue to take place in the Garden, we will look to develop an interactive online educational programme that can be accessed by plant lovers at any time and from anywhere.

• **Keywords:** *educational activities, workshops, classrooms, children*



## DOCUMENTING, SHARING, AND DISSEMINATING PLANT COLLECTIONS: THE EXPERIENCE OF THE PISA BOTANIC GARDEN

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To interpret, manage, and communicate knowledge effectively, a botanic garden must first have detailed and accurate information about the plants in its collections. The Pisa Botanic Garden recently implemented a new documentation system, named *U-plant* [1]. Then, in November 2021, we launched to public the platform *U-plant DISCOVER*, available in double language (ITA, ENG) and freely accessible online (<https://uplantdiscover.sma.unipi.it/>). This platform extracts in real-time a pool of data from *U-plant*. The homepage is structured into four main parts: (1) search fields, (2) latest arrivals in the collections, (3) a section hosting a set of thematic searches, and (4) a garden map. The basic search is carried out by scientific name, returning a list of specimens matched with a georeferenced map reporting their position in the garden. Each specimen is listed along with a cover image and some basic information; the 'Details' button allows to open the single record, providing additional information, like the family, the acquisition mode, the provenance type, and the sampling data (if available). The function 'Search in the Herbarium' allows to search for herbarium specimens of the same species in PI virtual herbarium (<https://erbario.unipi.it/it/site/index>). In the bottom part of each record lies a photographic gallery, showing all the photos pertaining to the specimen archived in *U-plant*. Through the function 'Send us your photo', the user can actively provide photographic documentation related to the specimen in cultivation. The user can apply also other filters using drop-down menus ('Advanced Search'), specifically pertaining to 'Family', 'Floristic Kingdom', 'Sector' (i.e., one of the seven areas which compose the garden), and/or 'Collection'. The 'Latest arrivals' section displays the latest four introductions in the garden in chronological order. The 'Search by themes' section provides some proposals for thematic visits, each composed by a brief introduction, a list of specimens and their position in the garden.

As future implementations, we are evaluating to add the plant common names as search criterium and to implement a more seamless function for photos submission.

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• **Keywords:** *biodiversity information management; database; documentation*



## BIODIVERSITY AND ART: INCORPORATION OF NATURE AND ART PROJECTS IN VILNIUS UNIVERSITY BOTANICAL GARDEN ACTIVITIES

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Value of art as a natural science communicator has been known for centuries. The polymath Leonardo da Vinci referred to art as “the queen of all sciences, communicating knowledge to all generations of the world” (Missinne, 2018). There is growing societal awareness of the importance of getting people outside to connect with nature with both body and mind (Ives et al, 2018), and botanical gardens provide such opportunity.

Vilnius University Botanical Garden (VU BG) counts solid age of 240 years, it has outstanding experience in interchange of science, culture and education. Thousands of visitors visit to discover abundant plant collections – over 40 educational, thematic, biodiversity, scientific etc. Artistic activities here are looked at as other possibility for visitors to meet with nature and learn about biodiversity issues. Art exhibitions, art-based education activities and projects aim to engage different target groups, create new relationships with living elements. In 2021 –30 cultural and art events took place, including 13 exhibitions. Workshops such as “Botanical Garden Studio’21” aims to acquaint with alternative photography, the use of plants in photographic processes. Project “Artists and Botanical gardens – Creating and Developing Educational innovation”(Erasmus+) creates dialogue between natural scientists, artists and teachers to create assignments for experiential learning and participatory pedagogy. Art exhibitions take place not only indoors. Since 2003, 16 Land and Environmental Arts Exhibitions were organized in 54 ha territory. Artists from different countries are provided opportunity to develop dialogue between art and nature, between artist and viewer. 2 photography albums of 205 artist’s works are published presenting it.

Connecting different artistic and educational activities that are linked to natural science, VU BG contributes to raising public environmental awareness, art events involve different target groups in learning biodiversity issues.

• **Keywords:** *artists and Botanical gardens, land and environmental art, Vilnius University Botanical Garden, biodiversity*



## FLORE DE GAND - HERBARIA AT THE CROSSROADS OF HORTICULTURE AND BIODIVERSITY

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The Ghent University Botanical Garden was founded in the late 18th century as part of a central school and flourished alongside the emerging interest in both botany and horticulture. One of the first garden directors, Charles Van Hooerebeke (1790-1821), built an extensive herbarium, containing the natural flora of the region.

As Ghent gradually became a center of horticulture in the nineteenth and twentieth century, the garden contributed to this evolution by providing courses in horticulture and botany and by raising a generation of famous horticulturalists. Herbaria that were built by the garden directors during this era testify of the rich collections the botanical garden held at the time.

Flore de Gand, a three year heritage project funded by the Flemish Region, focused on revisiting and digitizing these herbaria, allowing us to open the collections to the public. Cooperation with IT-specialists, archives and the horticultural community made it possible to view these herbaria from different angles, both botanical and historical.

First of all, the herbarium of C. Van Hooerebeke, facilitated the investigation of the evolution of the natural flora in the region of East Flanders, highlighting the steep decline of the botanical diversity over the last 200 years. A further heritage project (Florient) zoomed in on this subject and allowed us to raise awareness of the impact of human activities and climate change on the natural flora. Furthermore, the herbaria of father and son McLeod provided the opportunity to restore the link between the botanical garden and the horticultural community in Ghent. These herbaria testify to the 'golden age of horticulture' in Ghent. They formed the starting point for a crowd sourced project on photographs of horticultural relics in the region, which resulted in more than 1000 images. These were then mapped to points of interest and combined into guided tours (walks and bicycle tours) to highlight the horticultural history of the region.

At different times during the project public events were organized in order to get the audience involved. The project also aimed at documenting some of the historical horticultural techniques that are still used in the region. The project site provides more information on the project: <https://www.floredegand.be/>.

• **Keywords:** *herbarium; horticulture; heritage; biodiversity*



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## **WHERE IS EUROPE STANDING CONCERNING THE GSPC TARGET 8? A STUDY ON WILD SPECIES SEED BANK COLLECTIONS IN THE FRAMEWORK OF THE COST ACTION CA18201 "CONSERVE PLANTS".**

**Andreas ENSSLIN**

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Seed bank collections of wild species are crucial to securing populations and species threatened from extinction, but also as a source of material used for conservation measures such as plant translocations. The Global Strategy for Plant Conservation sets the goal to secure 75% of threatened species in ex situ collections (target 8a), but to date there is no comprehensive overview over where we are in Europe concerning this goal, neither is there coordination among European countries concerning the coverage of threatened species in their seed banks, or a concerted vision on how to go on. Within the framework of the COST Action "Conserve Plants", we made a comprehensive survey of seed collections of wild species stored in seed banks across 31 European countries. In total we assembled more than 150,000 accessions from more than 110 seed banks and crop gene banks representing to our knowledge the large majority of known wild plant seed collections for conservation purpose in Europe. Analyses of the dataset is ongoing and will be focussed on different subjects such as the GSPC targets, the geographic and phylogenetic coverage of the collections as well as their use for conservation measures.

• *Keywords: GSPC Target 8, seed banks, genetic diversity, ex situ conservation*



## MEISE BOTANIC GARDEN 2.0 IS READY FOR THE FUTURE

**Koen ES**

*Meise Botanic Garden, Botanic garden, Meise, Belgium*

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In 2022, Meise Botanic Garden will celebrate its 225th anniversary. But Meise Botanic Garden is more alive than ever. The last seven years investments were made to be ready for the future. The Touristic Business Plan 'Meise Botanic Garden 2.0' was implemented and resulted in a complete make over. This resulted in a contemporary visitor experience. Through six storylines: the world garden, people and plants, the tree of life, historical gardens and the green ark, the public can discover different aspects of this Botanic Garden.

Investments were also made in infrastructure and gardens. E.g. the Medieval Garden, a nod to the distant past when monasteries and castles had landscaped and structured gardens. The plants are grouped according to their use: edible plants, medicinal and ritual plants. In the Scents and Colour Garden, plants grow from which perfumes and dyes are extracted to colour textiles but also food. The historical walled garden was also revived. This Culinary Garden is a return to the past. Visitors will discover the plants eaten in our regions today, from prehistoric collectors to the foodies of the 21st century. The emphasis is also on the culinary traditions of Belgium: on beer, fries, chicory and Brussels sprouts. Whether you are young or old or have a disability, everyone can garden and the Botanic Garden wants to focus on that. Schools, groups and people with disabilities can learn about gardening and take part in cooking workshops. In Culinary Garden, an outdoor kitchen has been specially set up for this purpose and there are raised plant beds and plant pots that can be wheeled under.

The Stately Avenue was also completely redesigned. This way, this avenue regains its former grandeur, but with a modern touch: the old beech avenue has been replaced by Metasequoias, which are more resistant to climate change. The comfort strips that flank the cobblestones also make it easy for prams and wheelchairs. The new Rose Garden and the Wood Museum complete the picture.

The two new reception building with ticketing, garden shop, sanitary facilities and the restored Flemish Farmstead, in which exhibitions can take place, are located at the entrances. Access is controlled at both entrances by means of self-scan at the entrance gates. This means that no unnecessary time is lost, as tickets can be purchased online in advance. Meise Botanic Garden is ready for the future.

• **Keywords:** *tourism, visitor center, visitor experience, food, people with disabilities*



## **NON-COMMERCIAL USE OF PLANT GENETIC RESOURCES AND THE NAGOYA PROTOCOL OF THE CONVENTION ON BIOLOGICAL DIVERSITY: ASSESSMENT OF EXPERIENCES AND IMPLICATIONS IN GERMAN SPEAKING COUNTRIES**

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Since 2014, the Nagoya Protocol of the Convention on Biological Diversity regulates the international exchange of genetic resources. Until today, the implementation of these regulations is problematic for non-commercial research or collection projects. This paper relates the experiences of non-commercial users of genetic resources from German-speaking countries to the requirements and national implementations of the Nagoya Protocol, based on a survey of representatives of non-commercial institutions from German speaking countries. For the assessment of the exchange of genetic resources by non-commercial actors, different partial aspects of the implementations of the provisions on Access and Benefit-Sharing were used as a basis for the survey. Although Article 8 (a) of the Nagoya Protocol intends to encourage and promote simplified access to genetic resources for non-commercial research purposes, the results of the survey show a clear discrepancy between the intention of the Nagoya Protocol and the actual implementation in many areas. The findings provide up-to-date conclusions on how the implementation of the Nagoya Protocol affects non-commercial use of genetic resources. Problems with collection permits, voluntary standards not providing sufficient support for the application of ABS provisions, lack of functionality of the Access and Benefit-sharing Clearing-House, changes in sources of genetic material, and modification or termination of research projects due to difficulties related to implementation provisions of the Nagoya Protocol are key impediments that could be identified. Due to these problems, the Nagoya Protocol is viewed rather critically by many users for non-commercial research and collection activities. By identifying the problems and deficiencies that arise, appropriate improvement measures can be developed and implemented. The results of the present study are also taken into account in the context of a current Darwin Initiative project (DIR26S2\1034 (27-016): responsible exchange of plant genetic resources for research and development).

• **Keywords:** *Nagoya Protocol, non-commercial use, plant genetic resources*





## THE PHYLOGENETIC PLANT SYSTEM GARDEN IN NATIONAL BOTANIC GARDEN, VÁCRAÍTÓT

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The National Botanical Garden of the Center for Ecological Research is the richest BG of Hungary, having more than 13.000 taxa. The garden itself was founded in the 19th century in English landscape garden style. In 1871 the garden came into possession of Count Sándor Vigyázó, who passed the estate down to the Hungarian Academy of Sciences in his last will in 1920.

After the II. World War, in 1952 the development of BG began intensively, and a Phylogenetic Collection was established inter alia. It comprises 1.5 hectares and presents approximately 3000 flowering plant species and varieties from all over the world, resulting the richest Hungarian open-air systematic collection of angiosperms.

The order beds were designed by director Dr. Miklós Ujvárosi, based on the new phylogenetic system of the Angiosperms elaborated by the Dr. Rezső Soó /MoHAS/ (1953). Prof. Soó developed a vertical system of structure with six parallel evolutionary series (4 dicot. 2 monocot.) arranged in a way that the nearly 90 plant families grouped in separate beds showing simultaneously their relationship and phylogenetic development.

The order of the beds have been arranged like a fan with an artificial hillock in the focus point. The most ancient flowering plants can be found on the hillock-top (Berberidaceae, Ranunculaceae), paths leading from the hilltop show the parallel directions of development and separates the individual branches. Related plants are thus near to each others, allowing easy comparison for botanical study.

The collection primary aim is to present temperate perennials and annual herbaceous flowering plants, but in order to relieve summer heat and to avoid monotony, it became necessary to diversify the panorama with the help of smaller shrubs and climbing plants.

New plants are produced primarily through international seed exchange programme, as we are in contact with over five hundred gardens in Hungary and abroad.

Besides its scientific and educational role, we retain our collection as historic print and value of the evolution of plant taxonomy and systematics.

• **Keywords:** *open-air systematic collection, phylogenetic system, education*



## PREPAREDNESS IN TIMES OF RAPID CHANGE AND EXTREME EVENTS – BOTANIC GARDENS AND DISASTER MANAGEMENT PLANNING

**Joachim GRATZFELD, Noelia Alvarez de ROMÁN**

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As with other institutions, over the past two years, botanic gardens have not been spared the calamitous effects of the global COVID-19 pandemic and severe weather-related events such as wild fires in Australia, heavy snow in southern Europe, massive winter storms and soaring summer temperatures in North America, or torrential rains and inundations in central and eastern Europe. Botanic gardens are particularly vulnerable to meteorological disasters as these affect both, people and plants. Compounded by the impacts of the pandemic, including loss of income, garden closure, reduced personnel or even loss of life, these events have been stretching the resources and resolve of many gardens to the limit. Whilst botanic gardens cannot escape such hazards, mitigation, preparedness, emergency response and recovery are fundamentals of resilience when struck by disaster. However, a review conducted by Botanic Gardens Conservation International (BGCI) in 2021 found that the majority of botanic gardens did not have a risk management strategy or policy in place as an institutional mechanism to confront hazards. Yet, the review has also shown exemplary models of resilience and potential for innovation that botanic gardens are capable of mobilising to ensure the maintenance of their collections and facilities, and to remain engaged with the public. It is important to draw on these examples and learn from existing risk management strategies, to be better prepared in the event of disaster, mitigate the impacts and recover more quickly.

• **Keywords:** *Botanic gardens; preparedness; rapid change; extreme events; disaster management planning; resilience*



## ENVIRONMENT, SUSTAINABILITY AND BIODIVERSITY IN A CHANGING WORLD

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Biodiversity conservation, like all aspects of sustainable development, requires community awareness and engagement. This paper explores two case studies engaging participation from non-professional volunteers in field research, and changing attitudes to land restoration in the wider community. The two long-term science-based projects were designed to monitor the post-Acid Rain recovery of headwater forest catchments in the Jizera Mountains (Northern Bohemia, Czech Republic), and to correct the post-project deterioration of soils and vegetation on land reclaimed after surface coal-mining in South Wales (United Kingdom). For many people, the natural world is outside their everyday lived experience. But, an effective environmental management at the landscape scale can be sustained only with the support of communities involved in the decision-making process. Anyway, to be effective in this role, they need to know enough to be able to make informed decisions. It can be achieved through both direct engagement in the field research and environmental sound education. Those case studies demonstrate also the engagement of university students in the restoration projects and environmental education as well. These processes are affected by the length of time it takes people to achieve decision-making levels in their different careers. In the beginning of a new biodiversity conservation strategy period, the successful restoration projects have positive messages for people dealing with plant or biodiversity conservation and environmental education.

• **Keywords:** *acidic rain, recovery, Jizera Mountains, South Wales, restoration, field research*



## EX SITU CONSERVATION IN NATIONAL BOTANIC GARDEN VÁCRÁTÓT

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Tibor BÁRÁNY, Géza KÓSA, Vince ZSIGMOND**

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National Botanic Garden in Vácrátót is a nearly 200-year-old romantic landscape-designed garden, plant collections comprise 13000 plant taxa on 27 hectares. Mosaic-like structure of the area provides opportunity for a wide range of plants to grow in different habitats.

*Ex situ* conservation of native protected plants is one of the main missions of botanic gardens. Member gardens of Hungarian Association of Arboreta and Botanic Gardens (HAABG) cover altogether more than 1000 hectares where they house some 20 000 plant species/varieties. Almost 75% (511 species) of native plant species protected by Hungarian law are on display and/or involved in conservation activities in at least one of our member institutions, accordingly they play a key role in the *ex situ* conservation of protected/endangered species in Hungary.

*Ex situ* conservation of native protected plants is one of the main missions of botanic gardens. In Vácrátót, numerous members of Hungarian flora are grown and propagated. 124 protected and 7 strictly protected taxa live *ex situ* at the area of the garden. Some spontaneously appearing species complete this list, 13 protected and 1 strictly protected taxa have been found so far. Furthermore, three protected mushroom and a moss species were listed from the area of Botanic Garden.

Besides the full-grown living plant individuals, a significant seed bank of Hungarian wild flora is maintained by NBG. Huge assortment of seed samples of former Pannonian Seed Bank LIFE+ Project is part of *ex situ* conserved plant taxa, with all together 1853 samples of 910 native taxa, including 364 seed samples of 204 protected species (35.8% of Hungarian protected taxa) and 76 samples of 45 strictly protected species (51.7% of Hungarian protected taxa). Our aim is a long-term preservation of seeds of the wild vascular flora of the Pannonian biogeographical region.

In total, using different conservation methods NBG Vácrátót conserve 342 taxa (52.1%) protected by Hungarian law.

• **Keywords:** *ex situ, protected plants, conservation*



## NATURE CONSERVATION IN AN URBAN ENVIRONMENT

**Bettina HAMEL**

*Merian Gärten, Botanic garden, Basel, Switzerland*

The Merian Gärten in Basel (CH) are located on 18 hectares of land, surrounded by a dynamic urban environment. 40% of the area are classified as nature reserve and are in part protected at the highest level as they are nationally significant: The so-called dry meadows (Mesobromion and Xerobromion grasslands) have developed through centuries of extensive use and are the habitat of a large number of endangered animal and plant species. As a botanic garden, we strive to combine high standards of in situ-conservation and high horticultural standards for the cultivated gardens, to create an oasis for humans and nature alike. However, this often brings conflicts.

There is the justified wish of the urban population to have easy access to green spaces adjacent to their home. Wishes for new paths and bicycle routes through sensitive areas or for play and picnic areas are at the top of the wish-list. The meadows are often perceived as open space where development is possible because there is "nothing" there. Next to the colourful and cultivated ornamental gardens, their value as biodiversity hotspot is often little known, their beauty easily overlooked. It is our task as a botanic garden to make these sensitive habitats known and to make them accessible for visitors while protecting them from over-use.

In the Merian Gärten, considerable effort has been made to enhance conservation of our dry meadows and to raise public appreciation. Our presentation will show, how we have approached this:

- The task of promoting biodiversity today is a self-evident part of the corporate philosophy.
- At the organisational level, we have included a conservation biologist in the team. She advises the gardeners on maintenance in favour of biodiversity.
- In the most recent redesign of a third of the gardens, we have enlarged the natural areas and strictly separated them from areas cultivated with ornamental plants. The latter have been removed from sites particularly suitable for the natural expansion of dry meadows.
- Last but not least, we have improved our communication measures on all channels to promote the coexistence of top-class horticulture and valuable natural areas as the USP of our gardens.

• **Keywords:** *Biodiversity in urban areas, Conservation Gardens, Corporate Strategies, conflict of objective*



## HUMANS - INVASIVE OR KEYSTONE SPECIES? IMPLICATIONS OF SPATIAL AND HISTORICAL DISPARITIES FOR PLANT CONSERVATION

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*Gothenburg Botanical Garden, Gothenburg, Sweden*

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Ever since the pleistocene, the biodiversity of northern Europe has been heavily affected by large herbivores and humans in addition to having to migrate in response to repeated glaciations. As a result, a large proportion of the plant species of these ecosystems are adapted to grazing, trampling and repeated disturbance, not least by traditional human activities such as haymaking and burn-beating. At the same time, humans have replaced the original megafauna with domesticated livestock and turned the natural landscape into a scattered archipelago of refuges in a vast ocean of agriculture, roads and cityscapes. In contrast to this picture, many tropical island ecosystems have been void of humans and large herbivores until the last few centuries and largely contain plant species without such adaptations.

For the reasons stated above, the combination of climate change and land use now poses large challenges for our way of managing European biodiversity. I argue that humans, including botanical gardens must take the historical and spatial differences of human impact into account when decisions about appropriate plant conservation actions are being made. Interventions such as integrated ex/in situ conservation, city tree planning, assisted migration, reintroduction of species, rewilding, burning etc are all tools that can be used but only after careful consideration of the context in which they are applied. I give a few examples of projects where such interventions are being made and the reasoning behind. I also argue that plant conservation projects need to be international or at least not restricted by political borders if species are to survive climate change in Europe during the coming decades.

• **Keywords:** *climate change, plant conservation, ex situ, city trees, integrated conservation, rewilding, assisted migration*



## THE PLACE AND ROLE OF ARBORETA AND BOTANICAL GARDENS IN THE HUNGARIAN GARDEN HERITAGE

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As a collective term, Hungarian garden heritage comprises the historical heritage, related to all the branches of garden design and cultivation, which is a substantial part of Hungarian culture. Garden design and botany have been closely linked throughout history. Plants are one of the most important artistic and iconographic components of ornamental gardens and ornamental kitchen gardens. The curiosity and the passion for collecting and exploration of the world, which are characteristic of man's nature, has motivated the acquisition of exotic, foreign plants, in addition to the existing native plants. In Hungary, amongst the first, it is the early Renaissance period which left written records showing the passion of King Matthias and his court for special plants, which were introduced into the royal gardens. Giving curiosities as gifts also became a tool of diplomacy over the centuries. The collections of plants related to medicine were housed in the gardens of medical botany and later the university botanical gardens. The gardens of noble mansions, and later castles, also became increasingly exotic, including even collector's gardens. And finally, the collections designed for scientific purposes, botanical gardens became living museums of our culture.

The mission of the Hungarian Garden Heritage Foundation is to promote the sustainability of historic gardens and other gardens of historic value, including the arboreta and botanical gardens with an outstanding importance and special function, to raise social awareness of their scientific and artistic value, to position them in our culture, and to integrate them into the network of domestic and international garden tourism. The Hungarian garden heritage is a diverse and rich heritage, which poses many challenges for the heirs. Therefore, in addition to providing financial source for maintenance, it is important to train the professionals involved in maintaining gardens and to develop a career model for gardeners. In accordance with international practice, networking for the exchange of interns and volunteers will also help to raise awareness of these gardens, while maintaining them to a high standard.

• **Keywords:** *garden heritage, ornamental gardens, ornamental kitchen gardens, develop a career model for gardeners*



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## MODELS OF FABACEAE-FLOWERS AS TOOLS FOR UNDERSTANDING INTERACTIONS BETWEEN FORM AND FUNCTION

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Flowers of Fabaceae exhibit a considerable range of functional traits regarding their interactions with potential pollinators. They all are based on the same principle floral structures. Therefore, models of Fabaceae-flowers are especially well suited to understand processes of co-evolution and how small changes in architecture or arrangements of floral structures can result in quite different functions. Consequently, we have developed handicraft instructions for functional Fabaceae flower models suitable for being used in the classroom or outdoors in combination with real flowers (e.g. in Botanic Gardens). Based on one of these models, exhibiting the “explosive mechanism”, we will present how the process of building such models and their playful comparative use can trigger curiosity and understanding of evolutionary processes and interactions between form and function.

• **Keywords:** *Fabaceae, flower models, co-evolution*





## THE MAIN DENDROLOGICAL VALUES OF THE BUDA ARBORETUM, ITS ROLE IN HIGHER EDUCATION AND ENVIRONMENTAL EDUCATION

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The Buda Arboretum is one of the richest garden collection in Hungary. It is located in the heart of Budapest, surrounding the buildings of the Buda Campus at the southern foot of the Gellért Hill. The Buda Arboretum is primarily a demonstration garden, its most important function is to provide the basic conditions for higher education, it's a "living textbook" of the curriculum for higher education in horticulture and landscape architecture. The role of the garden in education is well illustrated by the fact that during an academic year the university's lecturers hold a total of nearly 2,000 lessons in the arboretum, which exceeds 40,000 lessons per year in student contact hours based on the number of students of courses.

The first plants of the arboretum were planted in 1893-94, today the plant collection covers an area of 7.5 hectares, where live to nearly 2,000 ornamental trees and shrubs, and hundreds of herbaceous perennials. The oldest trees in the garden are over 120 years old, such as the oldest *Parrotia persica* of Hungary, as well as several older specimens such as *Platanus occidentalis* and *orientalis*, *Fagus sylvatica* 'Pendula', *Carya cordiformis*, *Quercus libani*.

As a green area in good ecological condition and continuously being developed, the garden, it is of great value in the center of Budapest. Moreover it provides an opportunity for researchers and students to acquire and expand their knowledge, and for the citizens to relax. The environmental education of the arboretum is also significant, as it provides space for the students of many elementary and higher education institutions in Hungary to discover the living environment and the diversity of the living world in nature.

The arboretum has a unique microclimate in the country, the design of the southern slope, the system of fencing and retaining walls, and even the urban environment make it one of the warmest areas in Hungary, so it has a rich Mediterranean and subtropical open field collection.

Particular attention is paid here to Hungaricums: the treasures of the Hungarian dendroflora or the results of Hungarian breeding, such as the Hungarian *Sorbus* species and varieties, the world famous *Fraxinus ornus* 'Mecsek', and the Hungarian varieties of *Tilia tomentosa*. Dendrological introduction is also a significant task of the arboretum.

• **Keywords:** *Buda Arboretum, horticultural education, enviromental education, old trees, living classroom*



## CONSERVING NATURAL FOREST STEPPE WITHIN THE TERRITORY OF THE SOROKSÁR BOTANICAL GARDEN

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Soroksár Botanical Garden*

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Situated at the periphery of Budapest, on the sandy and alluvial deposits of the Danube river, the Soroksár Botanical Garden is outstanding for its natural and reconstructed vegetation fragments that are remnants of the Pannonian forest steppe. Within the 60 hectares the garden preserves tens of thousands of specimens of protected species and serves as in situ protection sites since almost 60 years.

On the natural *Molinia* fen meadow beside the six wild orchid species, *Iris sibirica*, *Dianthus superbus*, *Galium boreale*, *Schoenus nigricans* a huge *Ophioglossum vulgatum* population has been also preserved. Monitoring of the species and habitat diversity, population demographic studies are performed continuously by students assisted by colleagues of the botanical department. However, the closeness of the metropolis provides a lot of disturbance and therefore weed control and sustainable nature protection activities, especially on the sandy steppe is a continuous necessity. Wetland reconstruction was done in 2015. Moreover the garden serves as a sanctuary for forest steppe species, that were removed when the M6 highway was constructed.

Due to its large size the garden is also a refugia and a safe habitat for birds, amphibians, reptiles and for many protected insects. Most of species belonging to these groups have been compiled and studied by Hungarian experts of the related taxonomic group.

Beside in situ conservation the garden serves also as ex situ location where Pannonian steppe species are maintained and propagated. Latter activity is made in close cooperation with the National Parks.

• **Keywords:** *Pannonian forest steppe, in situ, ex situ, monitoring*



## HOW BOTANIC GARDENS AND SEED BANKS CAN CONTRIBUTE TO EXPERIMENTAL RESEARCH ON PLANT ADAPTATION TO CLIMATE CHANGE

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The ecological crisis caused by climate change and habitat destruction forces us to seek for more accurate methods for assessing the adaptive capacity of species. Estimates of extinction debt and future extinction rates vary considerably, reflecting the limited knowledge of essential parameters concerning species' adaptive capacity in changing environments. Phenotypic plasticity and rapid genetic adaptation may offer some plant species a buffer to modify their morphology, physiology, and reproduction to comply with new environmental conditions. Adaptive plasticity, which encompasses an increase in genotypic mean fitness, is therefore a crucial component to be accounted for in forecasts of environmental-change impacts. For threatened plant species in particular, the shortage of empirical data reduces our ability to account for variation in plasticity and evolutionary potential when making predictions about turnover, extinction, and community change. This empirical data can be obtained, for example, via transplant experiments or utilising carefully controlled greenhouse conditions simulating climate change.

To identify the key and often interrelated mechanisms for adaptive potential in plants, rigorous experimental approaches must be employed. In a unique project based in the Botany Unit of the Finnish Museum of Natural History we explore both temporal and spatial variability in the thermal responses of plant species. Using extensive experiments in the seed laboratory, greenhouses, and experimental fields within the network of European botanic gardens, we will analyse (i) standing intraspecific variation in phenotypic trait means and plasticity across time and space, (ii) phenotypic plasticity within individual life cycles, (iii) evolutionary potential of populations and species, and (iv) maladaptation due to climate change. These kinds of range-wide surveys combined with resurrection experiments studying multiple trait variation and population-level evolutionary potential could not be possible without professional sources of plant material, such as seed banks, and the invaluable support from a network of botanic gardens providing experimental sites. Here, we present the first set of results from the projects and describe the next steps, with a special reference to support gained from natural history collection units. We also extend this view to further options for the development of research support.

• **Keywords:** *botanic garden, seed bank, common garden experiment, adaptive plasticity, evolvability, maladaptation*



## IN VITRO CULTURE AS A METHOD OF EX SITU CONSERVATION OF VALUABLE PLANT SPECIES OF THE ROMANIAN FLORA; A CASE STUDY AT AL. BORZA BOTANIC GARDEN

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The Global Strategy for Biodiversity Conservation (2011-2020), claims that "at least 75% of threatened plant species to be preserved in ex situ collections, preferably in the country of origin, and at least 20% to be available for recovery and restoration programs" (target 8).

The botanical gardens represent the most active groups for the implementation of GSPC targets at regional and national level. (Jackson and Kennedy, 2009). Classical ex situ conservation methods are based on plant collections in botanical gardens and seed collections, while modern methods involve the use of biotechnologies through in vitro culture and cryopreservation. The plant conservation strategy involves a minimal assessment of the threats and management of the reference species as well as the ex situ conservation methods applied (Gao and Sun, 2018).

The collection of plants preserved by in vitro culture in the botanic garden Al. Borza include a number of 21 endemic or with different degree of threatment plant species, of which we mention: *Dianthus callizonus*, *Silene nivalis*, *Silene dinarica*, *Moehringia jankae*, *Dianthus glacialis ssp. gelidus*, *Dianthus pratensis ssp. racovitzae* etc. The first studies of this type were made here since the 2000s and continue today, the last species introduced in the culture being *Saussurea porcii* and *Convolvulus persicus*. In this study we want to present some results obtained by acclimatizing in botanic garden of the species preserved in vitro. Among the results of such studies we note: the development of effective protocols for in vitro conservation of plants and their sustainable use, based on research and practical experiments, as well as obtaining accessible ex situ collections to be used in ecological reconstruction and restoration programs.

Ex situ collections in botanical gardens can be very valuable in case of extinction of a taxa, because they can give plants to restore the population.

• **Keywords:** *Ex situ conservation, Dianthus, Saussurea, in vitro culture, ecological reconstruction*



## COMPLEX CULTURAL HERITAGE OF ALEXANDRU BORZA BOTANIC GARDEN IN CLUJ-NAPOCA (ROMANIA): FROM PLANT COLLECTIONS TO HISTORICAL ARTEFACTS

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Although botanic gardens can be managed for different purposes, their most important mission is "holding documented collections of living plants for the purpose of scientific research, conservation, display and education" ([www.bgci.org](http://www.bgci.org)). In this paper we want to emphasize the role of these institutions in another direction than the research and conservation of plant diversity: the preservation and promotion of historical and cultural heritage.

The case study we want to present here is that of the Roman Garden within the Al. Borza Botanic Garden (Babeş-Bolyai University in Cluj-Napoca), one of the most interesting ensembles on the territory of this institution. It is a unique ensemble in Romania, its main purpose is to present plants grown in Roman gardens, as mentioned in the writings of Pliny the Elder. However, the most original part is represented by a remarkable collection of historical artefacts that were found in various historical sites of the city of Cluj-Napoca and that were donated to the botanic garden for conservation and exhibition. Thus, the most attractive pieces for the general public are the statue of the goddess Ceres and two Roman sarcophagi from the cemetery of the ancient city of Napoca. Along with these, there are other pieces from the Roman era, but also more recent ones, made in different styles: Gothic, Baroque, Neoclassical, etc. In 2021, through a collaboration with the National Museum of Transylvanian History, all the artefacts from the Roman Garden were identified, each of the approx. 50 pieces that are exhibited in this sector being signalled and labelled in a modern way. There was also a sustained promotion of this heritage, through dedicated guided tours, social media campaigns and presentations in traditional media (written, audio, TV).

The highlighting and signalling of such collections in botanic gardens is very important for the visiting public, increasing their attractiveness, especially during the resting period of the plants in the cold season. In addition, in the current context of the COVID 19 pandemic, access to this cultural heritage brings important added value and a viable alternative to active recreation during this period, when many indoor spaces of the garden were closed (greenhouses, museum).

### ACKNOWLEDGEMENTS

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• **Keywords:** *plant diversity, cultural heritage, Roman garden, education*



## SCIENCE COMMUNICATION IN BOTANIC GARDENS: THE EUROPEAN PANORAMA

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Botanic gardens (BGs) promote people's connection with plants, making them a key site for the public to learn about plants. Botanic Garden Conservation International (BGCI) recognises public education as a criterion to assess and value these institutions, and BGs do offer a variety of science communication activities that facilitate and raise awareness about the plant world, e.g., citizen science, science cafés, exhibitions, and guided tours.

BGs have expressed their commitment to broadening audiences, education, and contribution to public debates, aligning with the Action Plan for BGs in the European Union (2000). Since the implementation of this Action Plan, the field of science communication has developed considerably, moving from conceptualisations of the public as lacking knowledge to those in which citizens are seen as knowledge holders and creators. Hence, this study aims to explore the nature of science communication in European BGs, and how it relates to current science communication scholarship.

National Reports submitted to the European BGs Consortium were used to identify science communication practices. Most European countries' BGs networks complete these reports twice a year, including a section on activities in education and dissemination. 113 National Reports, corresponding to 27 countries, from 2017 to 2019, were analysed using a qualitative content analysis with an inductive approach.

A total of 1504 science communication activities were identified along with their audiences. For the nature of activities, 17 categories were identified. 'Events' and 'oral communication' were the most frequent. On the other hand, 'merchandise' and 'broadcast media' were scarce. We've identified 18 audience types. 'General public' and 'students' were the most targeted audiences, with guided visits being the main activity for them. BGs targeted the least activities to 'young people' and 'non-plant professionals'.

This first overview reveals that European BGs undertake a diverse array of science communication activities, showing that they are working to engage people in several ways. The offer ranges from simple communication activities (e.g.: lectures) to more interactive initiatives (e.g.: co-creation), while also embracing technological tools (e.g., virtual exhibitions). These institutions are working to engage various audiences, including underserved groups. Therefore, European botanic gardens seem to understand the importance of science communication to pursue their missions, with ample opportunities to grow.

• **Keywords:** *science communication activities, audiences, plant/botanic awareness, qualitative content analysis.*



## BREEDING AND APPLICATION OF HUNGARIAN AND NATIVE ORNAMENTAL PLANTS IN MODERN GREEN SPACE MANAGEMENT

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The use of annual and perennial ornamental plants can be a simple and easy-to-maintain way to make botanical gardens more colorful. Their use can also increase the richness of open, sunny areas and shady garden areas. The effects of an ever-changing climate can be felt more and more. Most of the herbaceous ornamental plants currently in use are cultivated and produced in Western Europe, making them accustomed to the humid continental, often oceanic climate. Surfaces planted with such varieties need to be watered more often in Hungary and re-planted many times (Kováts 1959).

The Hungarian University of Agriculture and Life Sciences currently has an assortment of more than 80 annual and perennial ornamental plants bred in Hungary. MATE is currently the maintainer of the gene bank, the sole owner of the varieties. The original and current functions of the annual varieties include the decoration of public flower beds. Their brightly colored flowers are brought from the second half of the summer and bloom all the way to the frosts. They are decorative even without irrigation until the end of the growing season. Grasses are suitable for decorating perennial beds and greening lawns. They give a bright, fresh green color and are excellent in drought resistance. The varieties still have excellent stress resistance, but the constantly increasing summer temperature makes the plants weaker, which has made it impossible to grow many old Hungarian varieties.

Therefore, we have set new goals for ourselves in the future. We treat the maintenance and gene preservation of old varieties as our priority; breeding new varieties suitable for the current climate; and the definition of new areas of application for old perennial varieties. Our goal is to create commercially important varieties that can be safely grown in the changed Hungarian climate without excessive irrigation, as well as providing adequate ornamental quality. The primary consideration in the research of the grasses we examined is their application in the urban environment. Therefore, we examine their suitability on green roofs under different stress effects. Our task is for these varieties to be revived and perfected under our hands, so that they can be integrated into the management of the Hungarian green space.

• **Keywords:** *annual, perennial, grass, ornamental, urban green spaces, green roof, breeding, genebank*



## ENVIRONMENT FRIENDLY PLANTS USE IN SENSITIVE AGROECOSYSTEMS

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Lithuania nowadays pays special attention to the balanced use of natural resources, assurance of animal and human well-being and health promotion and problem solving of agro-environmental and climate change issues. The alternative for ecological protection of garden plants against pests could be the use of perennial phytoncides plant. The plants with high level of phytoncides have strong aroma. Phytoncides are volatile compounds released by fragrant plants. To date, the practice of using phytoncid (phytosanitary) plants for the control of garden plant pests and diseases has not been applied in Lithuania due to various opinions. This would be of a particular interest to organic, biodynamic and other farms that aim to produce healthier products. For the experiment were used four perennial herbaceous medicinal plants: costmary (*Tanacetum balsamita* L.), peppermint (*Mentha piperita* L.), thyme (*Thymus serpyllum* L.) and oregano (*Origanum vulgare* L.), which are quite popular in Lithuania and have pronounced phytoncide properties. All phytosanitary plants are planted in pre-prepared fertile soil, on which vegetables were grown in parallel: carrots, onions and cabbage. In the demonstration trials, perennial herbs were planted with seedlings every 25-30 cm, in one row. Demonstrative and experimental fields have been installed in 10 Lithuanian farms according to the pre-established methodology in 2018-2019. In the context of sustainable and balanced activities in sensitive agroecosystems, it is appropriate to plant vegetable crops in close proximity to perennial phytosanitary (phytoncid) plants as an alternative ecological protection against pests and diseases. This was confirmed by a qualitative study of vegetables. Especially suitable for this is the use of peppermint and oregano. It is advisable to plant both phytosanitary plants together. The location chosen, the quality of the soil, its preparation, the climatic conditions of the season are of great importance for the more efficient use of perennial phytoncid plants for the protection of vegetables. It is advisable to plant medicinal balsamite, peppermint and oregano in pots at distances (2-3 pots per 1 metre are sufficient) or otherwise to control the spread of the root.

• **Keywords:** *Agroecosystem, phytoncides plant, vegetables*





## RE-ORGANIZATION FINALISED: THE NEW SYSTEMATIC DIVISION AT THE BG OF THE UNIVERSITY OF VIENNA

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Historical background and size of the Systematic Division are outstanding features of the Botanical Garden of the University of Vienna. The division nowadays covers about two hectares which is a quarter of the gardens area. In the course of time, it underwent several major changes according to new scientific perceptions.

To cope with the requirements of a University garden, there was a strong need for another major change to depict the latest accepted concept of the Angiosperm Phylogeny Group (APG IV). The installation of the Endlicher-Fenzl-Kerner-Weg within the division, implemented in 2015 and safeguarding historical aspects of the systematic division, was the starting point of this most comprehensive change for more than 120 years. Meanwhile, the whole systematic division is re-organized according to APG IV.

A master-plan was developed how to represent the different orders and families in the existing layout with many old trees. In general, the replanting follows the original idea of Endlicher to place basal entities at the bottom of the slight slope and to end up with the most recent entities at the top. In detail, the whole division was completely restructured, featuring a horticultural masterpiece. Profound knowledge of systematics and of species and their horticultural needs went hand in hand with databasing, labelling and the setup of information panels for visitors. More than 2.000 accessions of mostly herbaceous species are now planted in the division, representing most of the plant families that can be grown outdoors at the climatic conditions of Vienna. Some glasshouse accessions are added during the summer to complete a set of plants for science education, e.g. within Euphorbia.

Without the skills of a deeply involved head gardener the division could not have been reorganized into such a multifunctional area, scientifically up-to-date and at the same time aesthetically appealing, despite the fact that systematics might be considered as thankless task.

• **Keywords:** *Historical Heritage, Botanical Systematics, APG IV*



## IN SITU AND EX SITU CONSERVATION OF THE ENDANGERED PLANT *ARTEMISIA LACINIATA*

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*Artemisia laciniata* (Asteraceae) is found in Europe only in the National Park Lake Neusiedl, Austria in slightly saline meadows. In 2015 only 11 plants were known. Monitoring was carried out on a regular basis, also in respect to seed production, and 22 new, vigorous plants could be located near the known population. The main aim of the current project is to establish a sustainable wild population.

Ten new sites were established in the meadows. Achenes were sown on flat molehills from the previous year or onto freshly dug sites. Two different sowing times were trialed. Spring sowing was not successful while winter sowing resulted in a germination rate of 23.5%. Seedling survival was 6.5% over the first summer. Freshly dug sites were more suitable than molehills, probably because of less exposure to weather conditions.

Additionally, young plants raised in the Botanic Garden were planted in autumn. The seedlings could be raised in garden beds or in a frost-free glass house. Survival in the field one year after planting was 88.8%. Flowering could be observed in the second year.

Currently, regular mowing of the meadows is done in summer, when birds have finished nesting. The area around the *A. laciniata* plants is spared to allow seed set, which occurs at the end of October. In autumn and winter, the meadows get swampy. Since mowing is crucial for the survival of *A. laciniata*, a simple mowing regime is sought after. To optimize the mowing management, experiments were carried out in garden beds at the University in Vienna. The results showed that cutting back the plants to 80 mm (height of the mowing bar) in mid-June resulted in 25% fewer plants with inflorescences and 75% fewer inflorescences compared to the control group. The later the mowing took place, the fewer plants produced inflorescences and the lower the number of inflorescences was.

The measures taken so far can be rated as success, as the in-situ population has grown from 11 to 245 plants within the last six years. However, monitoring must be continued to evaluate long-term survival. As back-up a living collection is maintained at the Botanic Garden and seeds will soon be placed at the Millennium Seed Bank.

• **Keywords:** *Mowing regime, field planting, living collection, monitoring*



## ANGELICA ARCHANGELICA, FROM VIKING VEGETABLE TO NORDIC DELICACY - ON SAFEGUARDING TRADITIONAL KNOWLEDGE IN BOTANIC GARDENS

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Through a collaborative research project with grassroot organisations and Nordic chefs we aim to safeguard and revive traditional plant use in the Nordic area. Angelica (*Angelica archangelica*), locally called "kvann" serves as an example here. Throughout Nordic history, angelica has been a valued resource, often referred to as sweet. Its cultivation was once protected by law and the plant was grown in specific "kvangarder" (angelica gardens) in the Viking Age and the Middle Ages. Angelica's area of distribution expanded over time and its sugar content increased in some semi-domesticated varieties. In turn, humans relied on it as a food source and conveyor of cultural meaning and value. Angelica has now mostly disappeared from Nordic diets, but is becoming popular again in New Nordic Cuisine, a gastronomic movement dedicated to using local, natural, and seasonal produce to create new dishes often with unusual flavors and based on traditional knowledge.

Traditional knowledge or indigenous and local knowledge is increasingly recognised as quintessential for biological conservation and sustainable development. As this is a relatively recent recognition, there is a lacuna in many conservation approaches in this regard. Preserving biodiversity and its contributions to people does not only necessitate the future material presence of this biodiversity, which is partly being preserved in seed banks and living collections, but also the knowledge to grow, process, transform and utilise these species. This knowledge is currently held, at least partly, by both specialists in genebanks and botanical gardens as well as by indigenous peoples and local communities, including gardeners and farmers across the world. Traditional knowledge is at least partly tacit, so documentation strategies can never fully preserve it and should always be conducted in parallel with initiatives that support community-based plant use. As botanic gardens we are in a unique position that allows us to preserve living plant taxa while also preserving horticultural practices and encouraging sustainable plant use amongst our visitors and partner organisations. While we excel at keeping records of the plants in our collections, storing information on horticultural practice and traditional knowledge often proves challenging.

• **Keywords:** *Angelica, conservation, record keeping, traditional knowledge, Vikings*



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## NOT JUST A BUILDING – NEW GREENHOUSES IN THE GOTHENBURG BOTANICAL GARDEN

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*Gothenburg Botanical Garden, Gothenburg, Sweden*

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In 2026 the new greenhouses in Gothenburg (Sweden) will open their doors for the public. The building process has begun, and a smaller alpine house will be finished later this year. The new houses will provide better and more stable climate control for the plant collections, improved work environment, and an increased accessibility for visitors and pedagogic activities. The road to get here has been long and far from straight, and there are still a few curves on the horizon.

When the Gothenburg Botanical Garden opened in 1923, there was only a small and simple greenhouse on the premises. In the 1950s a greenhouse for tropical and subtropical plants was built and the collection of exotic plants grew. In the 1970s and 80s additions and renovations to the greenhouse were made, and now in 2022 we are in the midst of a complete do over. One of the greatest challenges is that the new house will be built on the same site as the old one, and thus must be built in two separate stages. There are many players involved in such a large project and more than once the conflict between function and design has halted the process. We are excited to share our journey with the botanic gardens consortium and discuss both dos, don'ts and our vision for the plant collections with these new facilities.

• **Keywords:** *greenhouse, plant collection, building process*



## THE ROLE OF THE BOTANIC GARDENS IN THE RESTORATION OF DECLINED MEDITERRANEAN FOREST ECOSYSTEMS

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Transitional wetlands and coastal forests are among the most degraded and threatened ecosystems in the European Union. This has resulted in many habitats and species in Mediterranean coastal areas having 'unfavourable', 'vulnerable' or 'near threatened' conservation status according to the EU Habitats Directive (92/43/EEC). Actions to improve habitats' conservation status are particularly needed in the 'Bosco di Palo Laziale' Natura 2000 site in Italy. It covers 50 ha and is largely composed of the habitat type 'Pannonian-Balkan turkey oak-sessile oak forests' (91M0) and transient habitat types particularly rich in biodiversity, such as the 'Mediterranean temporary ponds' (\*3170). These habitats, and the associated wildlife (e.g. Hermann's tortoise, European pond turtle, etc.), face several serious threats, including shrub encroachment, climate change and inappropriate forest and water management.

In the framework of the EU-funded project LIFE PRIMED (LIFE17 NAT/GR/000511) ([www.lifeprimed.eu](http://www.lifeprimed.eu)), the Botanic Garden of Rome (BGR) has implemented a set of traditional and innovative ecological restoration practices to improve the conservation status of the habitats and species of Palo Laziale, including an *ex-situ* propagation and in-situ reinforcement of keystone plants of the target forest ecosystem. To date, about 3.000 oak seedlings (*Q. cerris*, *Q. pubescens*, *Q. ilex*, *Q. suber*) and 1.000 plantules belonging to the plant community *Isoeto-Nanojuncetea* (*Isoëtes durieui*, *Isoëtes histrix*, *Ranunculus sardous*, *Lythrum tribracteatum*, *Mentha pulegium*, *Juncus bufonius*) have been propagated, with a germination rate of 63% and 82% on average, respectively. Two stocks of these plants have been translocated in Palo Laziale during the spring of 2021 to reinforce the native populations. Preliminary monitoring findings indicate that the action has been quite successful, although the survival rate of the introduced plants is under further investigation.

The positive outcomes of such activities demonstrate how the Botanic Gardens can provide technical-scientific guidance and in-depth expertise in the restoration and management of degraded ecosystems and endangered biodiversity, contributing to achieving the objectives of the EU Biodiversity Strategy for 2030 and other related international initiatives (e.g. UN Decade on Ecosystem Restoration).

• **Keywords:** *restoration ecology; EU habitats; ex-situ-, in-situ conservation; Natura 2000; LIFE programme*



## BARRIERS IN GARDENS – NOT ONLY STEPS AND STEEP SLOPES

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The botanical gardens serve not only as scientific institutions conserving valuable plant species. They definitely play an important social role as green metropolitan places of relax and education. Such places should be open and friendly to the large public including visitors with special needs. Those are not only people in wheelchairs. In any part of our lives, anyone can experience some kind and degree of disadvantage or disability.

Accessibility of botanical gardens is related to the existence of visitor barriers ranging from the well known and obvious ones to less apparent and more subtle, such as the lack of information available before a planned visit. Even very small changes can sometimes significantly increase accessibility and make the visit of the garden more enjoyable.

Going through the types of barriers and reflecting of their existence is the first step to make your garden more accessible. Sharing knowledge and getting inspired by the examples of good practice of other botanical gardens is always very valuable.

Prague Botanical Garden has been working on its accessibility for over 20 years. This effort is reflected in the arrangement of expositions, facilities, programmes and special events. In 2016-2019 an international project focussed on accessibility was held, resulting in a printed methodology and conference. In the last two years, during the period of covid-19 pandemic, new means of communication were found to ensure that our garden could remain as accessible as possible.

• **Keywords:** *botanical garden, accesibility, visitors with special needs, barriers*



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## BOTANICAL GARDENS AS A PART OF EUROPEAN CULTURAL HERITAGE

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Objective of the Erasmus plus project was to build international cooperation platform to create outputs showing botanical gardens in context of European cultural heritage. The project also focused on selected genera of ornamental plants, that are common to all four partner's gardens from different countries. They are genera *Iris*, *Paeonia* and *Hemerocallis*.

The essence of this project lays in summarizing of all aspect that the European botanical gardens presented in history, and it compares gardens participating in the project. They are Pruhonice Botanic Garden, Institute of Botany, CAS, Czech Rep; Vilnius University Botanical Garden, Lithuania; Wroclaw University Botanical Garden, Poland; Park der Gärten, Bad Zwischenahn, Germany. The obtained data was related to collections of irises, peonies and daylilies. It also pointed to the national and European aspects showing botanical gardens from different point of view. There are science, education, culture and art, social events and cultural heritage issues discussed.

Project's outputs are four methodology booklets in English and their electronic translations to four national languages available on-line. Methodologies describe irises, peonies and daylilies comprehensively in the cultural heritage context. Tables and charts are presented to demonstrate maintenance of the plant collections in different countries, recommended assortment was assembled, management and economic indicators compared, financing resources analysed.

Created solution provides a complete guide to the field of European botanical gardens presented on four selected genera of ornamental plants in the light of common cultural heritage. It proves botanical gardens as the significant part of European cultural heritage, science, education and citizen life.

We thank the European Union, Erasmus + Programme for supporting this project number 2018-1-CZ01-KA202-048171.

• **Keywords:** *cultural heritage, Botanical Garden, methodology, Iris, Paeonia, Hemerocallis*



## ON-THE-GROUND CONSERVATION OF *BOSWELLIA* SPECIES IN THE SOCOTRA ARCHIPELAGO (YEMEN)

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Frankincense trees (*Boswellia* spp.), economically important species that are intimately intertwined with human history since millennia, are currently endangered in Socotra Island (Yemen). Commerce with olibanum and other kinds of resin has been a common practice on Socotra since antiquity. Eleven endemic taxa have been described from the island, making Socotra the area with the largest radiation of *Boswellia* species globally. Despite being a UNESCO Natural World Heritage Site known for its unique ecosystems harboring a high proportion of endemic species, the biodiversity on Socotra is increasingly affected by human-induced and climatic impacts. Recent changes in land management practices by local people cause overgrazing, resulting in the lack of tree regeneration and ultimately leading to decline, even extinction of local populations. Moreover, locally intensified cyclones and prolonged droughts caused by global climate change, have recently destroyed mature frankincense trees across the island. Our *Boswellia* conservation project, founded by the Frankinia foundation, targets an evolutionary unique group of insular trees, focusing on a comprehensive inventory of frankincense tree populations including threat re-assessment for IUCN Red List, seed germination trials, support of *in situ* seed germination, seedlings protection and woodland restoration, on-the-ground conservation measures, including training and awareness for stakeholders aimed at local communities and technical staff to ensure a long-term conservation strategy, increasing the resilience of trees with high ecological and cultural importance. The project solution is in the hands of the consortium of several botanic gardens and knowledge institutes, led by Mendel University (Brno, Czech Republic), Ghent University (Belgium) and Sapienza University (Roma, Italy) in collaboration with Yemeni authorities and local communities.

• **Keywords:** *Boswellia*, *in situ* measures, seed germination trials, Socotra, conservation





## FROM THE WILD, TO THE BALKAN BOTANIC GARDEN OF KROUSSIA AND THEN IN PUBLIC: CREATING AN AWARENESS-RAISING URBAN PUBLIC PARK IN NORTERN GREECE WITH CONSERVATION PRIORITY PLANTS

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The Balkan Botanic Garden of Kroussia (BBGK), Hellenic Agricultural Organization - DEMETER addresses the needs of the GSPC focusing on threatened, endemic and rare native species of Greece and the Balkans. In this context, researchers and specialized scientists worked together for the implementation of the project "Improving the conservation of priority plants in the cross-border area". Amongst various deliverables, the conservation status of priority plants in the trans-boundary region was studied, and a small-scale Botanical Awareness Public Park (BAPP) was designed and created in Thermi, metropolitan Thessaloniki, northern Greece. The BAPP project's scope was to provide an important venue for introducing local community to the value of priority plants and local biodiversity, offering also environmental education and awareness. All wild plant material used in BAPP was documented in a multifaceted way and was considered as an applied research product after species-specific investigations. Currently, the BAPP project maintains *ex situ* in public view and for citizen awareness and pleasure over 1,000 plant individuals from at least 70 taxa that do not exist in the local trade, collected during botanical expeditions, which are assessed as (near) threatened, local or Balkan endemic or rare (uncommon) (classified into A, B and C priority plants, respectively). Simultaneously, the reproduced priority species and subspecies constitute the living core collections in a newly designed thematic section in BBGK. A mobile application with photographs and information was developed, aiming to provide another modern tool for raising public awareness during the Covid-19 pandemic.

• **Keywords:** *Botanical gardens, public parks, ex-situ conservation, priority plants, landscaping with native plants, environmental awareness*



## TALLINN BOTANIC GARDEN – EMBASSY OF THE PLANT KINGDOM

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Botanic Gardens as interdisciplinary institutions have always been connecting links between various disciplines: biology, ecology, horticulture, research, education, recreation and various cultural events. Additionally botanic gardens have always been able to hold international connection, even despite difficult times. The bases for all those different fields of operation are the vast plant collections from all over the world. The collections give a perfect opportunity to emphasize the importance and to raise awareness about global ecology and the World as whole.

Since the beginning of 2021 Tallinn Botanic Garden (TBG) with the support of Estonian of Foreign Affairs has been hosting the initiative "Tallinn Botanic Garden – Embassy of the Plant Kingdom". Within the project TBG offers the embassies residing in Estonia the opportunity to use its premises for a month to introduce the nature and culture of their country. So far the embassies taken part in the project are: Japan, Russia, USA, Hungary, Poland, Georgia, Italy, UK, Finland, Australia, Spain and Ireland. The project continues throughout 2022 and more embassies are going to be involved.

The nature of botanic gardens gives the embassies large scale to operate for choosing appropriate ways to introduce their country and chosen subjects. The wide nature of events – exhibitions, lectures, workshops, plant excursions, food presentations, music events etc. prepared in cooperation with embassies gives to the botanic garden good opportunity to host diverse array of functions and thus to attract the visitors/public otherwise hard to reach.

Advertising of the events has been using the resources both of the TBG and the embassies including outdoor media, social media, television and radio. Using different channels and the involvement of diplomatic connections gives the possibility to reach wider audience and is an excellent opportunity for international cooperation in the interest of plants and World intergrity.

• **Keywords:** *International cooperation, global ecology*



## THE ROLE OF MATE GÖDÖLLŐ BOTANICAL GARDEN'S TEMPERATE BAMBOO COLLECTION IN EDUCATION AND RESEARCH

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The Gödöllő Botanical Garden of the Hungarian University of Agriculture and Life Sciences (MATE) was established in 1959 as the first agrobotanical garden in Hungary. It is located to the NE of Budapest, in the town of Gödöllő (GPS:47.593027, 19.366136) as part of MATE Szent István Campus, on a hilly terrain at an elevation of 220 m above sea level on a total area of 4,3 hectares. The Gödöllő Botanical Garden (a local nature conservation area since 2008) a member of the Hungarian Association of Arboreta and Botanic Gardens (HAABG-MABOSZ) has a total of over 1800 plant taxa of which 110 are protected plant species from the Hungarian Flora. There are over 15 thematic collections from which besides the Collection of Cultivated Plants, Magnolia Collection, Relict Forest stand of ` *Aceri campestri-Quercetum roboris* `, Wild rose Collection, Hawthorn Collection, Rose Mallow Collection,

Buddleia Collection, Hortensia collection, Iris Collection, Systematic Beds, Seminatural Sandy Grasslands, the Temperate Bamboo Collection is one of the most significant. The Temperate Bamboo Collection was established as a thematic collection and was substantially enlarged in 2010 next to an already existing larger *Phyllostachys flexuosa* groove, the original propagation material of which was donated to the garden from a plant still growing in the 250 years old ELTE Botanical Garden (ELTE Fűvészkert) and planted out in the early 1960`ties as one of the first plants of the newly founded Gödöllő Botanical Garden. The Temperate Bamboo Collection has grown considerably over the years with a total of 87 taxa, including several temperate bamboo genera such as *Arundinaria*, *Sasa*, *Sasaella*, *Pleioblastus*, *Fargesia*, *Pseudosasa*, *Bashania*, *Semiarundinaria*, *Indocalamus*, *Shibatea*, *Oligostachyum*, *Hibanobambusa* and *Phyllostachys*. Especially the collection of *Phyllostachys* taxa with a total of 54 species and forms is outstanding and is the largest collection of this bamboo genus among public and private gardens in Hungary. The Temperate Bamboo Collection is co-curated by MATE Institute of Landscape Architecture and Garden Art- OPGSMRG staff and It serves as a living gene collection, a basis for multi-level thesis work in agriculture and life sciences and favored especially by students from BSc in Horticulture and Doctoral School of Plant Science PhD studies.

• **Keywords:** *Botanic Garden, bamboo, Phyllostachys, education, research*



## NEW TOPICS IN AN OLD GARDEN - CONTEMPORARY EDUCATIONAL CHALLENGES AT THE UNIVERSITY OF WARSAW BOTANIC GARDEN

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Historically, botanical gardens were often institutions closed for general public, focusing almost solely on plant collection development. Nowadays education and visitor-centered services are crucial components of modern botanic garden structure and are most often presented in the institution's mission.

At the University of Warsaw Botanic Garden we try to adjust our educational offer to the changing needs of our visitors. Through the last few years we can see a change in our clientele, both demographically and interest-wise.

Now, it is not only school groups that visit our Garden, especially after the pandemic lockdowns pushed the adults out to the greenery. Presented topics are not only related to biology and ecology. The visitors look for innovative, interdisciplinary and involved, for example a blend of art and science or botany and humanistics, as well as topics related to the ecological crisis.

As the University of Warsaw Botanic Garden Educational Team we bring up up-to-date topics and share contemporary knowledge about:

- Climate change and its challenges by organizing cyclic meetings #klimatycznybotaniczn
- Pollination crisis and biodiversity protection by organizing classes and Pollinator Sensitivity Festival, and workshops about compost in cooperation with Warsaw Greenery Management

Moreover, through cooperation with the Academy of Fine Arts and artists we are trying to show complexity and beauty of nature, while promoting botany.

In this presentation we share our latest educational projects as examples of how we try to accommodate those changing needs into our offer.

- **Keywords:** *education, art, climate change, biodiversity crisis*



## A QUARTER-MILLENNIUM-YEAR HISTORY - EÖTVÖS LORÁND UNIVERSITY BOTANIC GARDEN (ELTE FÜVÉSZKERT)

**László ORLÓCI**

*Eötvös Loránd University, Botanical Garden, Budapest, Hungary*

ELTE Fűvészkert, Hungary's first botanic garden is celebrating the quarter-millennium-year anniversary of its foundation (1771). Jakab Winterl, the first professor of the Botany and Chemistry Chairs of the University's Medical Faculty was the founder director of the belonging botanical garden. Its history is rich in numerous relocations and finally, 170 years ago with its last moving occupied its well-deserved place in the Festetics garden. The romantic garden got its fame by Ferenc Molnár's pen. The story of the well-known novel, Pál utcai fiúk (The Paul street boys), takes place in this garden. In the end of the 19th century growing number of population in Budapest required adequate medical care, so more and more clinical buildings were needed. The territory of the Garden shrunk to its one-third, but the deepest point came with the Second World War, when getting its glasshouses bombed and the remaining tropical plants were destroyed by the frost. The Garden got back on track quite quickly, simultaneously with the restoration work a series of developments took place. Due to the most significant renovation project in the early 2000s, except for the Castle, the entire Garden got renewed and modernized, reaching the European standards again. In 2011 its territory grew to 5.5 ha due to the acquisition of Huzella garden in Göd. In 2017, following the German "Grüne Schule" (Green School) idea, a training and educational garden called FűFa (Grass and Tree) was founded in Fűvészkert, providing gardening programs and summer camps for kindergarten and elementary school children. Currently, the number of its plant species and varieties is about 8,000 and are displayed in the Garden according to their taxonomic or biogeographic categories. The fundamental tasks of Fűvészkert are education and research, though promoting science to the public is an important duty as well. Besides the living plants the not living collections are: a 12,000-item seed collection, a ca. 5,000-piece library and a 30,000-page herbarium, facilitating students and researchers.

• **Keywords:** *oldest garden, heritage, reduced area, botanical museum*



## THE USE OF IPEN-NUMBERS IN SEED CATALOGUES OF BOTANICAL GARDENS

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The International Plant Exchange Network (IPEN) is a voluntary system established in 1997 by botanical gardens for the acquisition and exchange of living plant genetic resources in accord with the requirements of the Access and Benefit Sharing (ABS) regulations of the Convention on Biological Diversity (CBD). Today the network comprises 211 members from 35 countries, all accepting a Code of Conduct which includes the recognition of the regulations of the Nagoya Protocol requirements of the CBD. By establishing a unique identifier for each transferred plant genetic resource, the IPEN-number, IPEN is especially designed to increase traceability of the origins of plant material exchanged by botanical gardens.

One traditional way of botanical gardens to exchange plant genetic resources is through seed catalogues. In order to assess the application and thus the effectiveness of IPEN-numbers, seed catalogues received in 2020 and 2021 by the Botanic Garden, University of Vienna, have been analysed. The results underline the potential and effectiveness of the IPEN-number system. The number and frequency of IPEN-numbers used in the catalogues clearly enhance traceability of origins of plant material and thus can be considered as best practice for fulfilling the ABS requirements of the CBD.

• **Keywords:** *International Plant Exchange Network (IPEN), IPEN-number, Seed catalogues, Botanical Garden, Access and Benefit Sharing (ABS)*



## EX SITU CONSERVATION IN THE BOTANICAL GARDEN OF EÖTVÖS LORÁND UNIVERSITY

**László PAPP, László ORLÓCI**

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Botanical gardens were the first institutions where people dealt with ex situ conservation around the world. The Botanic Garden of Eötvös Loránd University (ELTE Fűvészkert) is the oldest botanical garden in Hungary, founded in 1771 to educate the medical students. Pál Kitaibel, our second director registered the locations of the native Hungarian species, including the rare *Crambe tataria* which was planted in the garden at that time. From the 1950's our director, Szaniszló Priszter was among the first who investigated the propagation possibilities of rare and endangered species in Hungary. From 1987 up to now we have had four ex situ conservation projects. In the ELTE Fűvészkert we cultivate 8259 plant taxa, including 336 protected in Hungary and 339 red listed species from all around the world, but just a few specimens per species. In 2007 we started developing genetically variable ex situ populations of 31 species with 100-200 individuals per species; we have been keeping them for long term. Some of these are glacial or interglacial relicts. Hungary is located at the crossroads of atlantic and forest steppe zone, where a wide range of species of steppes, forest steppes and closed forests can be found. Some other „ex situ species” are phytogeographically important: these may be Pannonian endemic or relict endemic species (e.g. *Ferula sadleriana*) or Pontic (e.g. *Astragalus dasyanthus*) floristic elements, which are distributed to East Europe and West Asia. The ex situ conservation programs have different means and targets, mainly introducing endangered species, but some of them undertake developing an „ex situ population” and re-introduce the plants to their former natural habitats. The ELTE Fűvészkert has done such replantations in some cases (e.g. *Eriophorum angustifolium*) and plans to do this with 12 other species in cooperation by the appropriate national parks. Every year we organise events related to conservation and in 2017 we established a „green school” (Grüne Schule).

• **Keywords:** *endangered species, protected species, reintroduction, replantation, ex situ population*



## BOTANIC GARDENS AS PLACES TO SUPPORT ESPC TARGETS AND GREEN INSTITUTIONS

**Erika KÓNYA-PÉNZESNÉ**

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The European Plant Conservation Strategy lasted a ten-year period and it is worth to evaluate its importance or success.

Our methodology shows a strong connection between sustainability indicators of an institution or city and working for EPCS targets. It can be a bridge to use the same methodology for greening an institute or a firm and to examine all the organisations who work for plants in agriculture, medical areas or in nature conservation. The model will be demonstrated through an evaluation system of a university, a department, and a curriculum which is a survey through questions and colour evaluation system. It shows that a strategy building can start with a very wide evaluation of the previous results and not only the community of experts can be part of the process but also institutions and firms. The green university audit can be widened to a green institution evaluation for supporting EPCS targets and this system can be used for raising awareness and building capacities for effective plant conservation. The main criteria of green universities and green institutes are the content elements and activities which support biodiversity strategy or sustainable development goals within the strategy of the institution and university. A detailed example represents the steps of the process.

• **Keywords:** *Botanic Gardens, university garden, EPCS, GSPC*





## DARWIN REVISITED: THE CORAL OF PLANTS

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Botanists have long been looking for graphical tools to summarize the classification and phylogeny of plants simultaneously. Such illustrations are inevitable for communicating general knowledge in botanical research and education as well. However, published diagrams focus only on a single or a few aspects of the present and past of plant life on Earth. The "Tree of Life" so popular in contemporary biology is a case in point: as I will show, if the tree is graph theoretical then its use is limited to demonstrate sister group relationships of relatively few taxa and molecular distances. If the tree is a metaphor, its interpretation in scientific terms is difficult if not impossible. Therefore, I introduce a new image type, the coral, whose potential usefulness in phylogenetics was first raised by the young Charles Darwin. Cladogram topology, phylogenetic classification and nomenclature, diversity of taxonomic groups, geological timescale, paleontological records, and other relevant information on the evolution of plants sensu stricto (*Archaeplastida*) are condensed for the first time into the same figure – the Coral of Plants. This image is shown in two differently scaled parts to efficiently visualize as many details as possible, because the evolutionary timescale is much longer, and the extant diversity is much lower for red and green algae than for embryophytes. A fundamental property of coral diagrams is that any part of the diagram may be enlarged to visualize phylogeny and classification of smaller plant groups.

The lecture is based on the following publications:

Podani, J. 2013. Tree Thinking. Time and Topology: Comments on the Interpretation of Tree Diagrams in Evolutionary/Phylogenetic Systematics. *Cladistics* 29: 315–327.

Podani, J. 2017. Different from Trees, more than Metaphors: Branching Silhouettes–Corals, Cacti and the Oaks. *Systematic Biology* 65: 737–753.

Podani, J. 2019. The Coral of Life. *Evolutionary Biology* 46: 123–144.

Podani, J. 2020. The Coral of Plants. *Acta Societatis Botanicorum Poloniae* 89(3): 8937.

• **Keywords:** *cladograms, phylogenetic classification, taxonomic groups, evolutionary timescale*



## DESIGNING THE THERAPEUTIC GARDEN

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At the very beginning plants were used for healing, as well as for food, as it is evident from historical remains of all ancient civilisations. With the exchange of plants between territories and their analysis of use, the wealth of knowledge about the use of plants for medicinal purposes had also increased. With the development of garden design, medicinal plants also found a place in them. Over time, horticultural therapy has evolved, which is a relatively new form of therapy with the use of plants and has led to the design of therapeutic gardens. Horticultural therapy is an interdisciplinary field that combines medicine, pharmacy, botany, ecology, physiology, psychology, rehabilitation science, sociology and ergonomics. It is defined as adjunct therapy for the treatment of somatic and mental illness. It can be an aid in occupational therapy, and their integration is called horticultural occupational therapy. So for the approach to rehabilitation of persons with sensory impairment (after a stroke, nerve damage, amputations), University Botanic Gardens Ljubljana designed at University Rehabilitation Institute Soča a special therapeutic garden. We planted plants that have very different leaf, stem or flower structures, allowing rough or fine perception, which can serve therapists to record what sensations their patients already perceive. The goal was to use plants characterised by measurable morphological traits to prepare a suitable scale for observing progress in patients' tactile sensitivity, which will upgrade the standardised methods. The garden is also designed in way, that part of the occupational therapy is also active work in the garden (weeding, pruning, hoeing).

• **Keywords:** *horticultural therapy, occupational therapy, rehabilitation, tactile sensitivity*



## A COASTAL REDWOOD GROVE IN THE BALATON REGION: CREATING A SUCCESSFUL PHYTOCOENOSIS IN UNFAVOURABLE CONDITIONS

**Zsuzsanna RÓNAY, Réka FOLLY**

*Folly Arboretum and Winery, Badacsonyörs, Hungary*

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The Folly Arboretum in Badacsonyörs, Hungary, is a heaven for warmth-loving exotic gymnosperms. This 117-year-old garden is famous for its majestic cedars and extensive cypress collection and many more old, rare or otherwise noteworthy, mainly drought-tolerant evergreens. Our first attempt to grow coastal redwoods - *Sequoia sempervirens* - dates back to the 1950s as a trailblazer experiment in Hungary. The very first tree was planted on a sheltered, yet dry, southfacing slope and it still thrives today, even though that habitat was not optimal for the species.

Based on positive past experience, one of the latest developments in the garden has been the creation of a redwood grove in autumn and spring 2018/2019. In addition to 30 redwood specimens, 150 specimens of 25 naturally-associated taxa were also planted. A raised wooden walkway meanders through this phytocoenosis, which was established under the guidance of Zsolt Debreczy.

The Folly Arboretum is situated on a south-facing slope above Lake Balaton, the largest freshwater lake in Central Europe. Thanks to its location, our (submeridional) temperate climate shows mediterranean influences: rather mild winters with minimum winter temperatures several degrees higher than anywhere nearby and rarely colder than -6– -8 degrees C, followed by hot summers. The average annual rainfall is 611.0 mm (24.06 inches), however, it is decreasing due to climate change and was just 520 mm in 2021. On the USDA zone map we are located in Zone 7, however our special mezo- and microclimate allows plants of Zone 8a as well. Coastal redwood forests in southern Oregon and northern- to central coast California thrive in Zones 8 and 9, respectively.

The selection of taxa to accompany the redwoods was primarily based on their sympatric range within the redwood zone, as well as their cold hardiness and lime tolerance. There are very few affordable methods to combat frost damage other than a plant's own cold-tolerance. Some environmental conditions, such as the soil's lime content can be altered by either changing the local soil composition or by using thick mulch layers. The ambient humidity is raised by mist sprinklers, and shade has been created with shade cloth, etc. We hope that our fast growing redwoods will rapidly increase the natural shade effect, simultaneously providing higher humidity and better soil conditions.

We have run into some difficulties and have lost some plants, but overall the grove grows increasingly spectacular and since its creation it has been exceptionally popular among our visitors.

• **Keywords:** *Folly, Balaton, redwood, Sequoia, attraction, tourism*



## THE DEVELOPMENT OF A POST-2020 GLOBAL STRATEGY FOR PLANT CONSERVATION AS A COMPONENT OF THE GLOBAL BIODIVERSITY FRAMEWORK

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The Global Strategy for Plant Conservation (GSPC), with its 16 outcome-oriented targets was first adopted by the Parties to the CBD in 2002. In agreeing to the development of a specific strategy for plant conservation, Parties acknowledged and recognised the special importance of plants as the basis of all life on earth and in providing the building blocks of all terrestrial ecosystems. In 2010, with the adoption of the Aichi Targets, the GSPC targets were updated and renewed, with a decision that implementation of the GSPC should be pursued as part of the broader framework of the Strategic Plan for Biodiversity 2011-2020. Significant progress was made on the achievement of the objectives and targets of the GSPC up to 2020, not least due to its success in mobilising the plant conservation and botanical community at local, national and international levels. However much remains to be done. The recent invitation to the Global Partnership on Plant Conservation to prepare a set of complementary actions related to plant conservation to support the implementation of the post-2020 global biodiversity framework provides a 'green light' for the development of a post-2020 GSPC, closely aligned with the post-2020 Global Biodiversity Framework. This presentation will review the main achievements of the GSPC to date and suggests ways in which European botanic gardens can support the emerging post-2020 GSPC.

• **Keywords:** *GSPC targets, biodiversity, policy framework*



## ENABLING RESPONSIBLE EXCHANGE OF PLANT MATERIAL FOR CONSERVATION AND RESEARCH

**Paul SMITH**

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Although digital tools for exchange of non-crop plant material between botanical institutions already exist (e.g. BGCI's PlantSearch with 25,000 records of plant exchange since 2008; Index Seminum with >200 participating institutions exchanging thousands of seed collections each year), none of these tools flag or track Access and Benefit-Sharing (ABS), CITES or biosafety regulations and compliance. BGCI's Darwin Project entitled 'Responsible exchange of plant genetic resources for research and development' has developed a user-friendly, web-based platform that will enable researchers and practitioners in developing and developed countries to:

1. Access and share plant material and associated data;
2. Identify and flag material that is subject to ABS, biosafety and CITES regulations;
3. Identify institutions that are applying best practice with ABS, biosafety and CITES regulations, including tracking of material supplied to third parties.

It is expected that the tools developed will result in greatly facilitated access to, and responsible acquisition of, plant material for biodiversity and development worldwide. The prototype material exchange platform and accreditation scheme for assessing best practice in regulatory compliance will be presented by the speaker as part of the ongoing consultation process related to the development of these new tools.

• **Keywords:** *access and benefit sharing; biosecurity; CITES; compliance; material/data exchange*



## PLANT KNOWLEDGE AND PLANT APPLICATION IN THE BUDAPEST ZOOLOGICAL AND BOTANICAL GARDEN

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Dendrology and botany in Hungary is in an exceptionally privileged position in Budapest, as several thematic collections support students' plant studies, one of the oldest and most diverse of which is the Budapest Zoo and Botanical Garden. The institution opened its doors in 1866, and although the focus of its visits has always been and still is on animals, the management and professional staff quickly recognised the importance of presenting habitats and developing collections that include plants. The majority of the dedicated application area (18 hectares) is occupied by animal houses and associated runs, but more than 8000 square metres are devoted to plant collections, mainly habitat-specific thematic collections such as the East Asian and North American collections.

The garden's plant collections provide students with the opportunity to study the plant species they have learned in university lectures in their correct use in green spaces of different composition.

Prior to Covid, a number of themed plant walks were held in the garden, which not only gave current and former students a new opportunity to learn about plants, but also helped graduate landscape architects to refresh their previously acquired knowledge with the taxa presented during the guided walk.

In the case of horticultural plants, there is the opportunity to examine both older specimens, 200-year-old woody stem plants, and taxa that are new to the nursery or horticultural supply (sometimes only available from abroad). In the long term, they may also follow up on species seen in possible experimental collections, such as a winter-hardy succulent collection in a landscape alien to its native habitat, or species of currently native and protected associations, such as the rock garden in front of the Xantus house. Other diverse plants include tropical and other frost-sensitive species, mainly seen in the garden's interiors, and core collections such as the National Bonsai Collection in the Japanese Garden.

• **Keywords:** *dendrology, collection, biodiversity*



## **DISSEMINATION AND AWARENESS-RAISING IN THE NATIONAL BOTANIC GARDEN**

**Éva SZAKÁCS, Gergely LUNK, Tímea FÖLDI, Erzsébet FRÁTER,  
Géza KÓSA, Barbara SÓLYOM, Vince ZSIGMOND**

*National Botanic Garden Vácrátót, Vácrátót, Hungary*

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The National Botanic Garden in Vácrátót is at the distance of 30km from Budapest, has been open for 70 years to the public and belongs to the Centre for Ecological Research. Its plant collection includes 13,000 taxa. It is a nature conservation area of national significance, which, together with its buildings and historical garden style, also enjoys historical monument protection.

Every year 80-100 thousand visitors come to our Botanic Garden mostly during the spring and autumn excursion seasons. Our goal is to sensitize them to the love of nature, to help in developing a commitment and sense of responsibility to nature, while imparting botanic and ecological knowledge. Our plant collections are used as living illustrative materials in the transfer of knowledge about the world of plants, which is realized through information in publications, on boards, posters, as well as through programs, events and thematic guided walks. Two interactive exhibitions also help those interested to learn more. In addition, the writings and books of colleagues are regularly published. We are present in social media for eight years, on the Facebook and for almost two years through Instagram we broadcast news on the Garden.

What are we offering our visitors this year? Garden on the CuBE with our series of programs (Culture – Botany - Ecology), which offers the meeting of science and culture the public with the active participation of the experts of our institute. With 26-30 exclusive guided walks on 9 topics performed by our curators, firefly walks during the 10-12 day of swarming time, and thematic walks and demonstrations on holidays, nature conservation and cultural days. With our four plant trails, periodical guides, guided walks for groups to sign up, classes, and an extraordinary biology class for kindergarten and school groups. In the presentation, we give a taste of our diverse dissemination activities.

• **Keywords:** *sensitize, boards, programs, guided walks, exhibitions, demonstrations, school, kindergarten*



## THE WISE TREES PROJECT - SUPPORT OF HISTORIC AND/OR BOTANIC GARDENS IN MANAGEMENT AND FAMILIARIZATION OF ANCIENT TREES

**Zsuzsa SZENDI, Vince ZSIGMOND**

*Hungarian Association of Arboreta & Botanic Gardens, Budapest, Hungary*

Old trees are high values and important attractions of historic and/or botanic gardens expected to be retained. On the other hand the special maintenance needs of these trees face garden managers several hard problems to be solved and requires serious resources.

Hungarian Association of Arboreta and Botanic Gardens (HAABG) has developed a project with the mission to give longer life, spotlight and reputation to these unique living creatures and to support historic gardens, especially botanic gardens and arboreta in Hungary and the neighbouring countries in the implementation.

WISE TREES initiative of HAABG provides complex means for complex needs of BGs, arboreta and/or historic gardens.

Supported by the EU Slovakian-Hungarian Interreg Program, HAABG together with the Slovak National Trust could start the first phase of this work in 2021 and lay the grounds of a long-term strategy. During the project realization we

- compile an inventory of wise trees and their home gardens from dendrological, historical and tourism marketing aspects,
- give practical knowledge and complex approach to garden managers,
- support tree survey and arborist services and
- develop online and on the spot public services to encourage people, especially families for trips to gardens, and let them experience the exciting history and ecological importance of trees and gardens from different aspects by contemporary gamified methods.

An important feature of this approach is that we realise interdisciplinarity in practice involving several experts with different knowledge even at the same time and space from dendrologists along arborists to tourism marketing advisors.

In the presentation we focus on the innovative mindset and the concept of WISE TREES project and show some delightful veteran trees and historic/botanic gardens from Hungary and Slovakia less known by European garden experts.

• **Keywords:** *historic and botanic garden, arboretum, veteran tree, old tree, arboriculture, interdisciplinary, garden tourism, eco-tourism*





## THE BOTANICAL GARDEN OF BUDAPEST

Eva SZIKRA

*ICOMOS, Historic Gardens and Garden Heritage Assets Subcommittee at the Hungarian National Committee, Budapest, Hungary*

Arboretums and botanical gardens established centuries ago are particularly important heritage conservation elements also from the aspects of garden history. Today, alongside their scientific objectives, these gardens have become important places for environmental education, conservation, recreation, and sophisticated entertainment. Several times they have become important tourism destinations.

Despite its relatively small size (3.3 ha), the Botanical Garden of the Eötvös Loránd University (ELTE) in Budapest is an outstanding representative of the Hungarian historical gardens. Owing to its historical buildings, significant botanical features and collections, the garden is an important asset for Hungarian heritage conservation. Historical research has revealed how the botanical garden, founded 250 years ago in Nagyszombat, has been forced several times for site alterations, and how these influenced the landscape design. In 1847, with the assistance of Palatine Joseph, the University purchased the estate of the Festetics family in Józsefváros, where it is also today. The archive provides a picture of how the former Festetics Garden, and the 10 hectares botanical garden in its glory days, in the last third of the 1800s, looked like. At that time, containing all the fascinating elements of landscape gardens, a pond, a cave, romantic features, and with its scientifically significant collection, the garden was also a popular place for the citizens of Pest. This splendid composition was reduced to the present extension due to the gradual expansion of the adjacent University campus. Despite the difficulties, the Botanic Garden's management and scientific staff have always tried to maintain the collection in a decent condition.

With EU funds for renovation, the garden took a great opportunity to get renewed in 2008. Between 2009 and 2011, the entire garden, the historic palm house, and the greenhouses were renovated. Thanks to the good cooperation of the renovation team, the entire ex-situ botanical collection was preserved, while the garden was renewed to meet contemporary needs, offering numerous educational and cultural programmes and evoking the historical atmosphere.

• **Keywords:** *botanical garden in the last third of the 1800s, environmental education, conservation, recreation*



## HERITAGE CONSERVATION ASPECTS REGARDING BOTANIC GARDENS AND ARBORETUMS IN HUNGARY

**Katalin TAKÁCS, Imola GECSÉNÉ TAR, Anna EPLÉNYI, Máté SÁROSPATAKI**

*Hungarian University of Agriculture and Life Sciences (MATE), Institute of Landscape Architecture, Urban Planning and Garden Art, Budapest, Hungary*

It is acknowledged that there are many overlapping conceptual nuances, slight differences in interpretation of different, closely related disciplines and definitions, likewise in dendro-botanical, landscape architectural or conservationist areas of expertise. In our study, we approach these aspects from three perspectives including the different 'garden terms' representing dendro-botanical aspects; the various 'value categories' and their elements associated with heritage conservationist point of view; and we also refer to the different intervention options representing the complex tasks associated with the management and protection of the collection based gardens.

A fundamental question that needs to be from time to time reconsidered is what are the values of such gardens with underlying historical layers in a given period, and in particular, nowadays? This will be presented through an interdisciplinary approach based on literature related to the different disciplines, interpreting the defined values in the context of cultural, botanical, historical, ecological, or utility background. Moreover, we present an overall (value)map based on the examples of various botanical gardens and arboretums of Hungary, including not only the oldest collection gardens with historical value, but also the more recently established and actively managed ensembles.

Our third commitment is to explain the 'integrated heritage conservation management approach', a methodology that is frequently applied for historic gardens in international practice, integrating interdisciplinary approaches from landscape architecture, botany, horticulture, plant protection, sustainable management, etc. These aspects we find all the more important to discuss, as – beside permanent presence and active garden functions – only a broad expertise with right competences, interprofessional cooperation and interdisciplinary dialogue can be a guarantee for the conservation of these pieces of garden art.

• **Keywords:** *garden heritage, conservation management, collection based historic gardens*



## PHENOLOGICAL ASSESSMENT OF WOODY PLANTS IN THE BUDA ARBORETUM FOR URBAN AFFORESTATION

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*Hungarian University of Agriculture and Life Sciences (MATE), Institute of Landscape Architecture, Urban Planning and Garden Art, Budapest, Hungary*

The Buda Arboretum is the living plant collection of the MATE, one of the most outstanding collection in Hungary. Arboretums and botanical gardens play an unquestionable role in research projects on climate change, in monitoring plant adaptation strategies and physiological processes, and in developing trends in plant applications for the 21<sup>st</sup> century. There are excellent opportunities to study the adaptive capacities of plants from different habitats around the world, often planted in unique compositions, which may replace in the future the less climate-adaptive taxa in current landscape plant use. The arboretum is particularly valuable in this respect, as it is located on the southern slope of the Gellért Hill in the heat island of the capital, and its microclimatic conditions and semi-intensive (sometimes extensive) maintenance mimic urban conditions.

In 2021, we evaluated the woody species of the 7.5 ha garden from a phenological, ecological and landscape aesthetic point of view. Of the 2653 specimens examined, we focused on taxa commonly used in urban forestry (such as *Acer*, *Celtis*, *Fraxinus*, *Gleditsia*, *Tilia* species and their selections), which almost completely cover the national public forestry, and on future potential (*Alnus*, *Eucommia*, *Ostrya*) taxa. In the frame of our study we compared taxon phenology and their responses to environmental change.

From a plant-application point of view, besides ornamental value, climate tolerance and foliage retention are of particular importance. In the overall assessment, we found that within genera, native taxa lag behind exotic taxa in canopy habit and are less adaptive to the harshness of urban stressed environments. In the Buda Arboretum, *Acer opalus*, *Ostrya japonica* and *Eucommia ulmoides* have shown excellent adaptation to the environmental conditions, while *Alnus subcordata* and *Tilia mongolica* have outstanding foliage retention, (for 37 and 30 weeks) drought tolerance and ornamental value, and can create new opportunities for modern urban tree planting.

• **Keywords:** *arboretum, phenology, urban afforestation, climate change*



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## PODCAST YOUR GARDEN

**Stina WESTSTRAND, Åsa KRÜGER**

*Gothenburg Botanical Garden, Gothenburg, Sweden*

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Gothenburg Botanical Garden podcast ("Botaniska trädgårdspodden" in Swedish) is one of few podcasts produced by botanical gardens in Europe, and is currently reaching about 3000 listeners per episode. The podcast started in 2016 with a new episode published every month. The podcast format represents a modern and accessible channel for working with education and outreach, one of the main pillars of the work in botanical gardens. During the pandemic, the podcast has also made it possible to reach out despite restrictions on guided tours and other more traditional outreach activities.

The focus of our podcast is to reach a broad audience, to engage people and make them curious about the world of plants. The listeners are invited behind the scenes and learn about both the plants and the different types of work in the garden from new perspectives. Discussions on plant evolution, research and cultural history are mixed with hands-on gardening advice and inspiration from our horticulturalists. The podcast is hosted by two of the garden's scientific curators.

We will discuss the efficiency and reach of the podcast format as a channel for communication for botanical gardens. With our podcast as an example, we will present workflows, challenges, and future possibilities.

• **Keywords:** *communication, outreach, podcast*



## THE AMUNATCOLL IT SYSTEM – VIRTUAL COLLECTIONS, FIELD APPLICATION AND SPATIAL DATA ANALYSES FOR ALL

**Justyna WILAND-SZYMAŃSKA<sup>1</sup>, Jerzy BŁOSZYK<sup>2</sup>, Marcin LAWENDA<sup>3</sup>,  
Maciej NOWAK<sup>1</sup>, Piotr SZKUDLARZ<sup>1</sup>, Bogdan JACKOWIAK<sup>1</sup>**

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More and more institutions decide to share digitized data with a view of advancing natural sciences and general knowledge about nature. Thanks to a project entitled "AMU Nature Collections - online (AMUNATCOLL): digitization and sharing of the nature data resources of the Faculty of Biology of Adam Mickiewicz University in Poznan", which was co-financed by the European Union from the European Regional Development Fund under the Operational Program Digital Poland, such an opportunity was also presented to our Faculty. The funding has enabled a creation of a new portal, which contains digitized information on preserved specimens and field data of organisms from different groups, including plants. The complex structure of the metadata and the advanced implementation of IT tools in the system of AMUNATCOLL was possible thanks to a close cooperation between university scientists and employees of the Poznań Supercomputer and Networking Center. Additionally, a free mobile application allowing to create own databases during the field trips was developed. Data, coming from the Natural History Collections of our Faculty and those collected by a user in a field, may be compared and analyzed thanks to the specialized tools for spatial analyses. So far, after a three and a half year period, we were able to include into this database information about more than two million specimens including 180 thousand multimedia files. The platform is available in Polish and in English and is undergoing a further development, however slower after the project end (<https://www.amunatcoll.pl>). Through AMUNATCOLL IT system we want to reach all groups of the society, not only scientists, but also teachers, pupils, authorities and institutions responsible for nature conservation and environment protection and all people interested in science and in need of a reliable biological and spatial information. This system can be successfully used to create virtual collections in botanical gardens.

• **Keywords:** *AMUNATCOLL, biodiversity, natural collections*



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## SYSTEM LEVEL THINKING TO IMPROVE THE RELEVANCE OF LIVING COLLECTIONS

**Andrew WYATT**

*Missouri Botanical Garden, Horticulture, St Louis, USA*

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With regard to living collections management the botanic garden community focuses on only a limited number of topics associated with optimizing and maintaining living collections processes. We tend to look at individual challenges rather than the full picture. More than ever it is critically important to employ system level approaches to understanding all elements, processes and challenges that affect living collections. The unique advantage of living collections is the ability to cultivate and maintain large diverse plant collections. Focusing on these strengths along with integrating centuries old techniques of curation with new technology, large data sets, data driven decision making and conservation genetics enhances our effectiveness. However, to fully implement and integrate innovative techniques and capitalize on the strengths of botanical / conservation horticulture requires us to develop new processes and consider staff capacity and training. In many cases it also requires adapting how we utilize landscapes. Examples from Missouri Botanic Garden will demonstrate how a systemwide approach will enhance the relevance of plant collections for today's and tomorrow's needs. Topics discussed will range from collections targeting to databases and staffing.

• **Keywords:** *Living Collections, Conservation, Collections Management and Curation*



## EFFECTIVE PLANT CONSERVATION: WHY BOTANISTS SHOULD STUDY ZOOLOGY?

**Marcin ZYCH**

*University of Warsaw Botanic Garden, Warsaw, Poland*

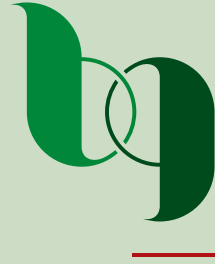
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In addition to protection of particular species, effective conservation of plant biodiversity must include measures to explore ecological links that enable healthy functioning of ecosystems. One of the most important processes that guarantee survival of plant populations is pollination of flowers by animals resulting in seed production. It is estimated that the successful reproduction of almost 90% of all vascular plant species is dependent on the activity of various pollinators. In our climatic zone these are mostly insects representing four major taxonomic orders – Hymenoptera, Coleoptera, Lepidoptera and Diptera. Lack of suitable pollinator taxa or decrease in insect populations' density may lead to pollen limitation resulting in lower seed production. The paper shows several cases of threatened plant-pollinator relationships and discusses that the understanding of species interactions, especially mutualistic ones, and the knowledge of plant species biology and ecology must be an indispensable element of any effective strategy of plant diversity conservation.

• **Keywords:** *conservation, ecological links, plant-animal interactions, pollination*







# WORKSHOPS

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## NETWORKING FOR PLANT CONSERVATION AND HABITAT RESTORATION

**Costantino BONOMI<sup>1</sup>, Erika KÓNYA<sup>2</sup>, Philippe BARDIN<sup>3</sup>, Jana TABORSKÁ<sup>2</sup>**

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*<sup>2</sup>Eszterházy Károly Catholic University, Department of Botany and Plant Physiology, Eger, Hungary*

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Developing successful plant conservation projects is a challenging task and requires an inclusive and multi-disciplinary approach, putting together diverse expertise to address many critical issues for a successful outcome. An integrated in-situ/ex-situ approach can yield numerous benefits and offer opportunities to showcase to the public the actual plants that need protection, building participation and support from the local community. As a case study the recently approved Life+ SEEDFORCE project will be illustrated. The project aims at improving the conservation status of 29 species reported in bad conditions according to the 2013-2018 report on the trends of habitats and species according to art. 17 of the Habitats Directive. Seedforce will both improve habitat conditions, removing or mitigate threats to the target specie survival and will actively reinforce demising population with well targeted plant translocations. A series of parallel engagement activities will gain public support and involve farmers that in most cases can influence the long-term conservation of many plant species in secondary habitats.

The workshop aims at sharing experiences, best practice and lessons learnt of successful plant conservation projects, providing a forum to discuss and develop new project ideas in an international perspective. The participants will discuss in small groups the benefits of networking for successful plant conservation and habitat restoration, debating thought-provoking questions and reporting to the plenary on what are the most urgent conservation priorities in Europe to the best of their knowledge, what key conservation activities are already in place, what are under development and what would be urgently needed, so that as an output of the workshop we could gain an insight on the most urgent conservation priorities in Europe, shortlisting current conservation priorities, active projects and new joint project ideas to be urgently developed in Europe.

• **Keywords:** *networking, plant conservation, habitat restoration, Natura2000, unfavourable conservation status*



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## BOTANIC GARDEN VISITORS DO NOT WASTE FOOD!

**Dominic GRANTLEY-SMITH**

*Botanic Gardens Conservation International, Education Team, London, United Kingdom*

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Many botanic gardens use food as a tool to highlight the important uses of plants as well as raising awareness of sustainability issues. However, it is not clear how much lessons learned in the garden translate into changed behaviour at home. BGCI decided to test this through a project based around reducing food waste.

BGCI's Food Waste Challenge was a 1-year pilot programme aimed at challenging botanic garden visitors to reduce their food waste over 30 days. Through an online tool, participants recorded the amount of fruit and vegetables wasted every week and lifestyle changes were suggested to help reduce food waste. Previous research had indicated that completing a 30-day challenge would lead to behaviour change and result in long term impact. However, results and feedback revealed a disappointing uptake and completion of the challenge. Perhaps botanic garden visitors are the wrong people to be targeted in this way?

In this interactive workshop, we will present the findings of the BGCI food waste challenge and will discuss with participants different food-related and engage in sustainability activities. Groups will work together suggest ways to "bridge the gap" between activities in the garden and behaviour change at home, especially when engaging with an audience who believe they already 'do their bit' for sustainability.

We will explore questions such as:

- What tools do gardens already use to foster continued conversation at home?
- Are botanic gardens visitors the right people to target regarding sustainability?
- Can we really create the same impact as we do in the garden online, or is there a place for digital engagement to support programmes.

• **Keywords:** *historic garden, infrastructure, research programmes, environmental education*



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## THE FUTURE OF LIVING COLLECTION MANAGEMENT: UNDERSTANDING THE IMPACT OF YOUR COLLECTION THROUGH VALUE SCORING

**Havard OSTGAARD<sup>1</sup>, Dr Samuel BROCKINGTON<sup>2</sup>,  
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*<sup>2</sup>Cambridge University Botanic Garden, Department of Plant Sciences,  
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*<sup>3</sup>Botanical Software, Bristol, United Kingdom*

*<sup>4</sup>Hortus Botanicus Amsterdam, Botanical Garden, Amsterdam, Netherlands*

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Depending on the focus of your mission as an institution, whether it is research, conservation, education, horticulture or heritage, some plants in your collection are regarded as more valuable than others. But how do you measure this value across a collection? How are your value judgments impacted by the collections of others? Are these values well defined and understood within your institution? Do you find it difficult to communicate these values and your mission to stakeholders and visitors? Are you confident that your plant collection is evolving in the right direction? These are some of the questions that a *Collection Value Scoring* (CVS) approach is trying to address. With more reliable plant collection metrics, your institution will also be in a much better position to move from individual hunches to truly data driven decisions.

Join our interactive workshop to share your thoughts, and hear three different perspectives on CVS. How can CVS contribute to the maintenance and development of your collections, and how can technology help your garden increase its impact? Our panel consists of Dr Sam Brockington, Curator at Cambridge University Botanic Garden (UK), one of the world's largest University-owned botanic gardens; Martin Smit, Collections Manager at Hortus Botanicus Amsterdam (NL), one of Europe's oldest botanical gardens; Havard Ostgaard, CEO and Dr Waheed Arshad, Botanical Scientist from Botanical Software who together bring their perspective on how innovative technology can enable all types of botanical institutions to make use of value scoring.

• **Keywords:** *collection management, value scoring, curation, plant records*



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## PEER-O-PEER LEARNING: CITIZEN SCIENCE AND COMMUNITY ENGAGEMENT AT BOTANICAL GARDENS

**Baiba PRUSE<sup>1</sup>, Suzanne SHARROCK<sup>2</sup>, Justyna WILAND-SZYMANSKA<sup>3</sup>,  
Monika SUSKEVICS<sup>4</sup>, Tsipe AAVIK<sup>5</sup>**

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<sup>3</sup>*Adam Mickiewicz University in Poznań, Poznań, Poland*

<sup>4</sup>*Estonian University of Life Sciences, Tartu, Estonia*

<sup>5</sup>*University of Tartu, Tartu, Estonia*

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The team foresees the European Botanic Garden Congress as the perfect platform to discuss and share best practices of the following themes:

- *where/how citizen science has been integrated across botanical gardens?*
- *where/how local community knowledge has been involved in the development of botanical gardens e.g. first initiators of the botanical gardens, the uses of plants.*

Cost Action 18201 ConservePlants Working group on human dimensions (<https://www.conserveplants.eu/en/working-groups/wg4>) in cooperation with DiGe project team (<https://www.unive.it/pag/33443>) aims to provide the ground for peer-to-peer learning where the examples are brought by the workshop participants. The success of the workshop will be based on the diversity of examples shared by the participants. Based on the questions of interest initial case studies will be presented by the organising team before opening the floor to open discussion i.e., example of Looking for Cowslips, histories of local women group initiating botanical gardens e.g. Iceland. The organizing team aims to combine the examples and outline them at ConservePlants web page as well as sees the potential to publish workshop output. For the workshop several tools will be employed including but not limited to safe place policy and Science Cafe principles. Proposed length of the session: 1 hour Hybrid mode: on place (plus providing the access of the potential participants via zoom if needed - depending on the pandemic situation)

- **Keywords:** *citizen science, local community, botanical gardens, peer-to-peer learning*



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## THE INTERNATIONAL PLANT SENTINEL NETWORK

**Lara SALIDO<sup>1</sup>, Katherine O'DONNELL<sup>1</sup>, Suzanne SHARROCK<sup>1</sup>, Charles LANE<sup>2</sup>**

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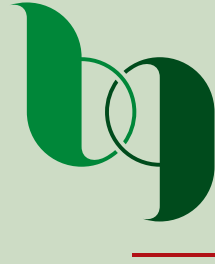
Invasive alien plant pests and diseases already pose a considerable threat to plant health worldwide. With the increased globalisation of trade in plants and plant material, and the effects of a changing climate, this threat is predicted to continue to rise. In recent years, the world has seen a sharp rise in the number of these harmful invasive organisms which cause large scale environmental and economic damage. A significant issue in managing this threat is predicting which organisms will pose a threat in the future, the 'unknowns' and understanding of pest/host relationships of the knowns.

Botanic gardens and arboreta are a unique and currently under-utilised resources that can support this research through targeted and general surveillance. Plant collections are estimated to include 30-40% of all known plant species, many of which are exotic species (and thus potential sentinel plants). Sentinels can help to build knowledge and to support the development of management plans and risk assessments. Botanical institutes can study a large range of plants, from new saplings to old specimen trees, in multiple regions/countries.

The IPSN focuses on increasing knowledge and awareness among garden staff, seeking best practise, developing standardised approaches and providing training materials and methodologies for monitoring and surveying.

The IPSN has various projects running in Europe focused on utilising botanic garden collections to provide an early-warning system for new and emerging plant pests and diseases. A network of over 40 BG&A in eastern Europe with *Fraxinus* spp. in their collections has been set up to monitor for Emerald Ash Borer through surveillance and trapping. The IPSN is also engaging botanic gardens with Beech spp. in their collections in the Euphresco project 2020-A-334 'Plant health status of *Fagus* spp. (FAGUSTAT)' to help scientists gain an understanding of the presence of Beech leaf disease in Europe.

• **Keywords:** *pests; diseases; sentinel plants; invasive; monitoring; capacity building*



# POSTER PRESENTATIONS

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in alphabetic order  
of the first authors



## THE NATIONAL GARDEN OF ATHENS AS HISTORICAL AND BOTANICAL HERITAGE IN GREECE

**Katerina AGORASTOU**

*City of Athens / National garden, City of Athens, GREECE*

The National Garden is one of the most important historic gardens in Greece, located in the center of Athens, in close connection with the Parliament Building, the former palace of the King Otto and Queen Amalia. The National Garden is closely linked with the recent history of Athens and is a place where the collective identity and memory of the city is preserved and developed.

The planting of the National Garden began in 1839, within an area of 2,5 hectares, with more than 15,000 ornamental plants being imported from other countries such as Italy (Genoa), France and Spain, while many native plant species were transferred from other greek regions such as Sounio, Evia and Sparti. In 1852 the National Garden reached its current size of 15,8 hectares and in 1927 the National Garden became public. The design and character have slightly changed since then in order to accommodate the new uses as a public garden.

The presence of mature trees of historical significance within the National Garden is very strong and there are well preserved specimens until today (*Cupressus sempervirens*, *Ulmus campestris*, *Platanus orientalis*, *Phoenix canariensis*, *Washingtonia filifera*, *Livistonia chinensis*, *Melia azedarach*, *Koelreuteria paniculata*, *Schinus mole*, *Phytolacca dioica*, etc). Many of the plant species introduced into the National Garden were widely used to form tree avenues, public gardens and parks in Athens.

The connection of the National Garden with the history of the city, is also strengthened by the discovery of the ancient Peisistratus aqueduct, in 1860, which is used uninterruptedly until today, to meet the irrigation needs of the Garden.

The National Garden has been included in the Hellenic Network of Botanic Gardens due to its rare plant collection by species, size and age and it has been officially designated as a Historic Landscape in 2011.

In 2004, the Municipality of Athens took over management of the National Garden for 90 years and in 2020 a new agency was established, with the responsibility of managing the National Garden (Green Athens SA). Contemporary management aims to enhance the historic and botanical character of the National Garden while meeting its other functions and visitor needs.

• **Keywords:** *National Garden, Athens, historic garden, botanic garden, historical trees, Green Athens S.A., City of Athens.*





## PHYTOCOENOLOGICAL DISPLAY OF MEADOWS AND DRY GRASSLAND COMMUNITIES OF LITHUANIA IN VYTAUTAS MAGNUS UNIVERSITY BOTANICAL GARDEN

**Arūnas BALSEVIČIUS, Ričardas NARIJAUSKAS**

*Vytautas Magnus University Botanical Garden, Kaunas, Lithuania*

The classical plant expositions are usually established on a systematic or geographical basis in universities botanical gardens and rarely – on an ecological principle. In Vytautas Magnus University Botanical Garden in Kaunas in 2018, we created a display of Lithuanian meadows and grassland communities based on phytocoenological principles, i.e. we exhibit plant communities by separate syntaxa.

The exposition consists of 14 beds with plant communities from 13 alliances and one association. This exposition displays the entire vegetation diversity of Lithuanian meadows and dry grasslands. The most diverse *Molinio-Arrhenatheretea* class (anthropogenic managed pastures, meadows and tall-herb meadow fringes on fertile, deep soils) is represented by *Arrhenatherion elatioris*, *Cynosurion cristati*, *Molinion caeruleae*, *Calthion palustris*, *Deschampsion cespitosae*, *Filipendulion ulmariae*, *Veronico longifoliae-Lysimachion vulgaris* alliances and *Cirsietum rivularis* association. The *Trifolio-Geranietea sanguinei* class (thermophilous forest fringe and tall-herb vegetation in nutrient-poor sites) is represented by two alliances: *Geranion sanguinei* and *Trifolion medii*. The remaining four vegetation classes *Festuco-Brometea* (dry grassland and steppe vegetation of mostly base- and colloid-rich soils), *Nardetea strictae* (secondary mat-grass swards on nutrient-poor soils), *Koelerio-Corynepherea canescentis* (dry grasslands on sandy soils) and *Sedo-Scleranthetea* (pioneer vegetation on shallow soils), which plant communities' diversity in Lithuania is not rich, are exhibited per one alliance.

Phytocoenology as a science for studying vegetation diversity is little known to the public. Therefore this display is significant for educational reasons, and exposition attendance can replace an outdoor expedition to learn about meadow species and the most common plant communities.

• **Keywords:** *Vegetation, meadows and dry grassland, living collections, Lithuania*



## ACTIVITIES ON EX SITU CONSERVATION OF FOREST GENETIC RESOURCES IN THE BOTANICAL GARDEN OF THE UNIVERSITY OF BANJA LUKA

**Sunčica BODRUŽIĆ<sup>1</sup>, Nikola TRAVAR<sup>1</sup>, Marina ANTIĆ<sup>1</sup>, Jelena DAVIDOVIĆ GIDAS<sup>2</sup>**

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The Institute for Genetic Resources of the University of Banja Luka is the institution responsible for the implementation of the Programme for Conservation of Plant Genetic Resources in the Republic of Srpska and the manager of the protected area University City, which includes the Botanical Garden of the University of Banja Luka. The main goal of the Program is effective management of genetic resources through continuous inventarisation, collection, evaluation and conservation of germplasm. A work group for forest genetic resources was formed within framework of the Program.

The poster presents the activities of the work group for forest genetic resources related to ex situ conservation of plant species of regional forest ecosystems in the Botanical garden of the University of Banja Luka. Ex situ conservation refers to the conservation of components of biological diversity outside their natural habitats (Convention on Biological Diversity, 1992). Ex situ conservation involves sampling, transfer, storage and propagation of plant species that cannot be stored in the form of seeds.

The Botanical garden, as part of ex situ collection, also carries an educational role and therefore this educational function was one of the parameters considered for species selection. The following species from the group of forest genetic resources were introduced into the botanical garden during the past 5 years: *Hepatica nobilis*, *Galanthus nivalis*, *Hypericum androsaemum*, *Artemisia absinthium*, *Asarum europaeum*, *Juniperus communis*, *Iris variegata*, *Iris graminea*, *Crataegus monogyna*, *Prunus spinosa*, *Viburnum lantana*, *Euonymus europaeus*, *Quercus cerris* and the species that are on the list of protected and strictly protected species of Republika Srpska (Decree on strictly protected and protected wild species "Official Gazette of Republika Srpska" No.65/20): *Cypripedium calceolus*, *Ruscus aculeatus*, *Ruscus hypoglossum*, *Anacamptis pyramidalis*, *Orchis simia*, *Dianthus petraeus*, *Sorbus domestica*, *Dactyloriza sambucina*, *Convallaria majalis*.

• **Keywords:** *germplasm conservation, protected species, genetic resources management*



## THE EXPERIENCE OF THE PLANT BIOLOGICAL DIVERSITY PRESERVATION IN THE STATE DENDROLOGICAL PARK "OLEXANDRIA" OF THE NAS OF UKRAINE

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The dendrological park "Olexandria" is one of the oldest parks in Ukraine (founded in 1788). It is located on the western outskirts of the Bila Tserkva city, Kyiv region, and covers an area of 400.67 hectares. The park was created on the basis of a centuries-old oak forest with additional exotic planting. At present, the area of the age-old oak forest is about 80 hectares. The total number of centuries-old oaks (over 200 years old) is about 2,000 samples.

According to the nature of the species composition, the tree and the herbal vegetations of the park belong to *Querceta (roboris)violosa (odoratis et hirtae)*. Among the tree vegetation, the dominant species is *Quercus robur*, which grows separately and in a mixture with *Acer platanoides*, *Tilia cordata* and less common others.

The early spring aspect of the herbaceous cover is represented by 12 ephemeroids species with a predominance of *Anemone ranunculoides*, *Ficaria verna*, *Gagea lutea*, *Scilla bifolia* etc.

Despite the active processes of environment urbanization, the dendrological park "Olexandria" succeeded in natural vegetation cover preservation. At the same time, the plant's biological diversity preservation is inseparably connected with the introduction and with assortment replenishment by new perspective species and forms.

Working on the introduction of new species into the local landscape has been carried out since the "Olexandria" Park was founded. Until now, in the park, are growing and are protected: *Pinus strobus*, *Pinus nigra*, *Picea abies*, *Larix decidua*, *Aesculus hippocastanum*, *Liriodendron tulipifera*, *Syringa vulgaris* and others.

In 1946, when the Park was transferred under the management of the AS of the USSR, the active work on the study and introduction of new perspective plants was resumed. Currently, more than 4,500 species, forms and varieties of plants are cultivated in the "Olexandria".

It is conducting large work in the park to preserve the diversity of fruit trees, including 61 varieties of the genus *Malus*.

The natural and cultivated vegetation of the dendrological park "Olexandria" is an excellent example of a harmonious combination of natural vegetation and hand-made park landscape.

• **Keywords:** *dendropark, biological diversity, history, preservation*



## VRBA, A DATABASE APPLICATION OF THE BOTANICAL GARDEN FACULTY OF SCIENCE, UNIVERSITY OF ZAGREB, CROATIA

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The digital transformation of the Botanical garden of the Faculty of Science, University of Zagreb (in the further text: "the Garden") was an uphill battle since the end of the 1990s, caused mostly by the shortage of human and technical capacities. During 2020, we conducted an in-depth analysis, digitalization and historic reconstruction of the Garden's business model and plant recording system which was the first step for a new staff member proficient in bioinformatics to create a comprehensive database application in 2021.

VRBA (acronym from Croatian "*Vrtna baza*"; "the Gardens database") is a web-based database application integrated as a full backbone for the Garden's operations. VRBA was developed on the XAMPP open-source cross-platform software stack and it is compatible with both stationary and portable devices. The front-end development was coded in HTML, CSS and JavaScript with utilization of the Bootstrap and AdminLTE frameworks. The back-end of the software was coded with PHP and MySQL (MariaDB). PhpMyAdmin was utilized for administration purposes. Custom raster layer for geospatial data was drawn using QGIS. Various open-source libraries were deployed with the most prominent ones being: jQuery, LeafletJS, DataTables, D3.js, Select2 and Font Awesome.

The released version of the software has the capacity to record and export: (i) plants' accession, historic, visual and geospatial data, (ii) research and seed storage data, (iii) archive and library records with digitalized media and (iv) business management and administration data. VRBA's main modules are fully integrated into the process of labeling and engraving of the plants' name tags, *delectus seminum* publishing process and on-spot data evaluation, inventarisation and mapping. Furthermore, VRBA's database structure was conceptualized to be compatible with *World Flora Online* taxonomic backbone, and an additional layer of algorithms was coded to deploy and ensure constant relevance of VRBA's taxonomic data.

The internal development and ownership of our own database application gave us the opportunity to completely optimize the software and digitally transform our business practices with the best possible fit for our needs. The results of our work prove that botanical gardens with limited staff members could thrive and have a great value with just one bioinformatician in their ranks.

• **Keywords:** *bioinformatics, botany, plant collection*



## THE COLLECTION OF *ACTINIDIA KOLOMIKTA* IN BOTANICAL GARDEN OF VYTAUTAS MAGNUS UNIVERSITY: PRESERVATION AND EVALUATION

**Laima ČESONIENĖ, Remigijus DAUBARAS, Paulina STREIMIKYTE**

*Vytautas Magnus University, Botanic garden, Kaunas, Lithuania*

*Ex situ* living collections of economically important plant species are an important resource for research and education in botanical gardens. Genetic resources of such plants are the country's biological heritage, which becomes the basis for maintaining biodiversity and developing breeding of new cultivars. In recent years, increasing attention has been paid to less known plants which fruits are rich in biologically active compounds with health-promoting peculiarities. Introduction of winter-hardy species *A. kolomikta* (Rupr. & Maxim.) Maxim. and *A. arguta* (Siebold. & Zucc.) Planch. ex Miq. occurred by introducing into cultivation in amateur gardens in Lithuania. Acclimatization of genus *Actinidia* Lindl. started at Botanical Garden of Vytautas Magnus University (VMU) in 1936. The main precondition for the modern studies of *A. kolomikta* genetic resources was establishing of the germplasm collection at Botanical Garden of VMU. Resistance to biotic and abiotic factors as well as growth and development of different accessions were investigated in 1996–2020. Simultaneously, we conducted the studies on genetic diversity using SSR method to base the breeding of new cultivars. Results of genetic structure assisted also to identify duplicate samples. DNA analysis should be a precondition to avoid duplication and to reduce the cost of maintenance of germplasm collection in the future. *A. kolomikta* berries are highly fragrant and tasty. Investigations of biochemical compounds in berries have confirmed exceptionally high levels of ascorbic acid, which can reach more than 1000 mg / 100 g, depending on the genotype. Studies on phenolic compounds in berries and leaves of *A. kolomikta* cultivars using the UHPLC-ESI-MS/MS technique corroborated differences among cultivars in the quantitative composition of individual phenolic compounds. Both berries and leaves showed the presence of phenolic acids, flavones, and flavon-3-ols. This indicates that *A. kolomikta* is a promising health promoting source of biochemical compounds with strong antioxidant activity. In summary, the collection of *A. kolomikta* germplasm in Botanical Garden of VMU provides a reasonable opportunity to develop further research of potential applications in food or pharmaceutical industries.

• **Keywords:** *Actinidia*, berry, collection, germplasm



## IMPORTANCE OF GENUS FUND PLANT COLLECTIONS OF BOTANICAL GARDENS FOR REGENERATION OF SWAMPS ECOSYSTEMS

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Swamps are one of most important ecosystems in the world. They ensure very specific biodiversity of plants and animals and are a store of huge amounts of coal, accumulated in the peat. Drainage of the swamps and peat extraction change these ecosystems very significantly. During some last decades many swamps in Lithuania disappeared and about 72 % of the remaining Lithuanian natural swamps are under unfavorable influence of different human activity. Such situation requires fast and active actions for the restoring of swamp ecosystems after peat extraction with recovering of specific plant carpet. The goal of the investigation was to prepare scientifically based recommendations for swamp ecosystem restoration in the fields after peat excavation. The experiment was done in the Western North Lithuania in the former swamp Aklasis Ežeras after peat excavation for 16 years. It was noted that natural recovering of swamp plants communities started quite fast after finishing of excavation works and increasing of water level in the fields. Plants of *Sphagnum tenellum* and *Eriophorum vaginatum* appeared in the fields mainly. Small amounts of other swamp plants like *Drosera rotundifolia*, *Andromeda polifolia*, *Ledum palustre*, *Sphagnum magellanicum*, *Sphagnum rubellum*, *Epilobium palustre* and *Bidens cernua* were noted in the territory of former peatland as well. Research data showed that restoring of swamps plant communities is possible during 25-30 years after excavation in average. In some places it can take about 80 years or even longer.

Plants of European cranberry (*Vaccinium oxycoccos*) from abundant genetic fund collection of Botanical Garden of Vytautas Magnus University were used for planting and ensuring diversity of this genus in the restoring swamp. Totally 11 different clones of European cranberry were planted in the recovering swamp plots. Genetic diversity of this species will promote resistance and vitality of those plants in the recovering plant community. More intensively spreading of cranberries will ensure a food supply for the birds who are living and nesting in the territory also.

• **Keywords:** *swamps, excavating, restoring, plant communities, cranberries*



## SPECIES-SPECIFIC TEMPORAL DYNAMIC OF ORCHID POPULATIONS IN THE *MOLINIA* MEADOW OF SOROKSÁR BOTANICAL GARDEN (BUDAPEST)

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Inferring biotic and abiotic factors influencing the dynamics of orchid populations requires a high temporal replication of demographic observations according to standard data collection protocols.

In this study, we analysed demographic properties of three orchid species, *Anacamptis palustris*, *Dactylorhiza incarnata* and *Gymnadenia conopsea* in the *Molinia* meadow of Soroksár Botanical Garden, with the purpose of setting up a standard, long-term comparative demographic study framework in the meadow. In 2021, we replicated a previous data collection (Dörmer, 2017) that entailed selecting five, 25m<sup>2</sup> plots separately for each species, placed randomly across the 12ha meadow. We counted the number of flowering and non-flowering individuals for each species and we compared the differences in these demographic quantities between the three species and between the two census years (2016 and 2021).

The number of individuals and their phenology varied largely between the three species, with *G. conopsea* having the highest, and *D. incarnata*, the lowest number of individuals. The *A. palustris* - *G. conopsea* and *D. incarnata* - *G. conopsea* species pairs had the largest number of significant differences detected across all demographic parameters. While the density of *G. conopsea* individuals had a more moderate temporal dynamic, the mean number of flowering and non-flowering individuals of *A. palustris* and *D. incarnata* varied largely between years.

We speculate that the large differences in the density and temporal variation of *A. palustris* and *D. incarnata* stands compared to the more stable populations of *G. conopsea* might be influenced by their pollination system. The gradual transition of the *Molinia* meadow towards more mesic conditions might as well cause more unpredictable demographic responses in these two species more sensitive to changes in soil humidity.

• **Keywords:** orchid, population, demography, environmental change, long-term dynamic



## THE HBLFA FOR HORTICULTURE AND AUSTRIAN FEDERAL GARDENS AS A SYNERGY OF LIVING TREASURIES, EDUCATION AND RESEARCH INFRASTRUCTURE

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The Federal Gardens include historical Gardens like Schönbrunn Palace Park, Augarten, Belvedere, the Hofburg Gardens in Vienna and Ambras Palace Park and the Hofgarten in Innsbruck. These gardens are also listed as historical monuments. Since 2016, the Austrian Federal Gardens and the HBLFA for Horticulture have formed a joint department. Since then, the department has established a synergy of plant conservation mainly through the botanical collections, research among other things to reconstruct and preserve historical plants and education through the horticultural school, where expert knowledge is passed on. The school garden of the HBLFA for Horticulture borders on Schönbrunn Palace Park and serves the students with its varied planting as a place of learning and recreation as well as a practical area for teaching. The botanical collections of the Austrian Federal Gardens including more than 130.000 plants representing more than 16.000 species and sorts and are one of the biggest collections of living plants in middle Europe. Over 450 years ago started by the imperial family of the Habsburgs, inherited by the Republic of Austria in 1918, gardening tradition and expert-knowledge are continuously preserved. The Botanical Collections are keeping and developing an important gene pool, supporting research facilities and science and make an important contribution to the national and international conservation of species. The main tasks correlate with the international commitment on keeping the biodiversity and the "Austrian strategy on biodiversity 2020+". The return of extinct *Erica verticillata* and *Erica turgida* to South Africa and building up the Global Conservation Consortium Erica (GCCCE) under the aegis of BGCI together with other partner institutions is to name one example. The research institute cooperates closely with many departments of the HBLFA for Horticulture and Austrian Federal Gardens to ensure the best possible species conservation. Among other things, historical plants are propagated and cultivated in the laboratories. Through research it is tried to bring those plants back to their original historical form, in example by means of cross breeding species. Current research projects on this topic are: The Hefka Orchids, The Klimt Rose and wild Tulip species.

• **Keywords:** *Research, education, gardens, collections*





## BRYOPHYTE COLLECTION OF ESZTERHÁZY KÁROLY CATHOLIC UNIVERSITY (EGR): THE DIGITAL DATABASE OF MALAGASY SPECIMENS

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The Bryophyte Herbarium of the University of Eger (Acronym: EGR) is considered to be one of the most important collections of this kind in Central Europe. Bryophyte specimens held at Eger count around 200.000 specimens, of which 1515 are the specimens collected from Madagascar. The oldest Malagasy specimen hosted in the herbarium is the isotype of *Brachymenium borgenianum* Hampe collected in 1870. Members of the Department of Botany has increased this part of the collection during their field research, especially by: Prof. Tamás Pócs who visited Madagascar four times accompanied in 1994 by his colleagues: Sándor Orbán, Gabriella Kis, András Szabó and András Vojtkó. Our main aim was to digitalize and publish information on the cryptogam herbarium in order to provide an easier access to the data. The digital photographs and the database are property of the Department of Botany and Ecology of Eszterházy Károly Catholic University. Data of Madagascar collection specimens database are summarized in an electronic appendix <http://sass.gyarmati.andrea.uni-eszterhazy.hu/> including: catalogue number, taxon name, collector, settlement, date of gathering and file name of the documentary photograph). Further data can be required from the curator of the herbarium.

• **Keywords:** *biological collections, Malagasy collection, herbarium digitization, natural history collections*



## THE BRYOPHYTE FLORA OF THE EÖTVÖS LORÁND UNIVERSITY BOTANICAL GARDEN IN BUDAPESTS

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There is growing recognition of urban areas as hosts of innovative conservation methods and promoting biodiversity. Botanical gardens and parks as one specific type of urban green space, constitute particularly important biodiversity hotspots in the cityscape. Knowledge of moss species in anthropogenic habitats of Hungary is limited and the published writings mostly contains a description of floristic data.

The locations of the vascular plants in arboretums are consciously chosen by gardener, but mosses spontaneously select the optimal habitats. They cover all accessible and favourable substrates and are represented by many ecological groups, including epigeic, epixylic, epilithic, epiphytic and aquatic groups.

The present research introduces the first bryofloristic study in the 250 years old Eötvös Lóránd University Botanical Garden. The main objective of the study was to determine the species composition, taxonomic and ecological diversity of bryophytes of the garden and to determine their substrate preference in the area.

• **Keywords:** *bryophyte diversity, life strategy, semi-natural habitats, comparison*



## VERTEBRATE FAUNA OF THE NATIONAL BOTANIC GARDEN

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The most part of the area of our botanic garden today may have been occupied by sandy grasslands two hundred years ago, as well as the rich shrub-level oak-ash-elm gallery forest along the Sződ-Rákos stream, and its original vegetation has survived in traces. Within the stone walls of the Garden, a collection of 13,000 plant taxa from five continents forms a diverse vegetation that is home to a variety of animals that are often no longer able to live in the man-made, cultivated parts of the landscape. The built topographic conditions of the Garden provide favorable conditions for many species, and the artificial ponds also shelter aquatic and water-bound taxa. Together these conditions make an exceptionally good habitat for many animal species.

Our garden is also a nature conservation area of national importance, so all plant and animal species living in the garden benefit of legal protection. Being a botanic garden, researching and surveying animals is not one of our main activities, but we observe them, their behavior and habits, take notes of their presence and help them to settle in the Garden as much as possible.

Among mammals, rodents, small carnivores and insectivores are present, as the Garden is fenced with a wall, big game can't come in. Based on the observations so far, the nesting of 62 bird species has been recorded in the Garden. The garden is also home to many species of amphibians and reptiles. More than 20 species have been registered in the stream and pond system to date.

In co-operation with the MME - Hungarian Association for Ornithology and Nature Conservation - a controlled artificial nesting den system and regular winter feeding also help birds to settle.

A good-eyed visitor may also find various types of animal traces, which may be footprints or chewed walnuts, hazelnuts. There are many signs of the rich fauna of the Garden, and the animal traces also provide valuable information for the Garden staff.

• **Keywords:** *vertebrate, animal tracks, observation*



## PHENOLOGICAL INVESTIGATION OF THE *FESTUCA TAXA* IN THE SANDY AREAS ALONG THE DANUBE

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The sandy areas along the Danube River with extreme dry, unfavourable conditions might have diffuse or sudden variations in the composition and value of the grass and other biomass causing challenge to planning and managing land use. *Festuca taxa* assumed to occur on the open sandy grasslands are the subjects of the study. The most important dominant species of these grasslands is *Festuca vaginata* and *Festuca pseudovaginata*. We planned to differentiate between these taxa with the use of morphotaxonomic, histological, phenological studies.

We studied each *Festuca taxa* occurring in the open sandy grassland, based on the assumption, that the time of development and flowering of the *Festuca taxa* is significantly different. This demonstration may be significant in managing land and climate protection. In addition, taxa potentially occurring in the area (*F. wagneri*, *F. javorkae*, *F. tomanii*) and other domestic taxa (*F. pseudovina*, *F. rupicola*) were analysed for comparison. The study was done on a living collection with six individuals of each species from Kisalföld to Bulgaria along the Danube. Data of times of flowering was recorded every three days between 2019 and 2021, from the end of April to the end of May.

These signals were used: 0 – does not bloom, 1 – visible inflorescence initiative (before flowering), 2 – beginning of flowering-25% is in bloom), 3 – above 25% is in bloom-full flowering, 4 – flowers die, 5 – it is in fruit.

Based on the results, we can conclude that *Festuca pseudovina* flowered first followed by *Festuca pseudovaginata*. *Festuca vaginata* flowered weeks later. The period of flowering of the *F. javorkae* was the same as that of the *F. rupicola*. Flowering of the *Festuca wagneri* lasted longer and this species showed well the geographical separation.

The work was supported by OTKA K-125423.

• **Keywords:** *flowering stage, phenological stage, panicle*



## CONSERVATION OF PROTECTED PLANTS OF NATIVE FLORA IN THE M. M. GRYSHKO NATIONAL BOTANICAL GARDEN OF NAS OF UKRAINE

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The Ukraine's native flora include of about 4,523 species of vascular plants. The problem of plant conservation is very important for Ukraine, because its territory is under anthropogenic and technogenic pressure. According to the Red Book of Ukraine (2009) the law protects 611 species of vascular plants. Biodiversity loss is one of the major social problems. Botanical gardens need to develop their collections, especially they must include and protect the rare and endangered plant species, to contribute to conservation of biodiversity. The M.M.Gryshko National Botanical Garden of NAS of Ukraine plays an important role as an ecological center and as the largest regional bank of plants. Rare plants are in the collections of almost all departments of the NBG, but tree species are concentrated mainly in the departments of dendrology and natural flora. Herbal plants are included in several local collections: «Medicinal plants», «Food plants», «Rare plants of Ukrainian flora», «Steppe plants», «Plants of Karpaty», «Plants of Crimea», «Plants of the plain part of Ukraine». The modern collection of protected plants in NBG is represented by 190 species. The leading department in the preservation of rare components of flora is the department of natural flora, which deals with the study of natural and artificial plant populations. Experience in growing protected plants in semi-natural conditions of the NBG has revealed the ability of some species to acclimatize, adapt and naturalize. Semi-natural populations of rare plants on botanical-geographical and some other areas are considered «introduction populations». Mainly geophytes form such populations. Other plants are represented by single specimens and small groups of individuals. The number of rare species and their representativeness in the NBG are often not sufficient for their successful ex situ protection. However, there are real prospects for expanding the list of species, breeding and cultivating them for distribution to other institutions or for the restoration of in situ populations.

Red Data Book of Ukraine. Plant Kingdom, Didukh, Ya. P., Ed., Kyiv: Globalconsulting, 2009.

• **Keywords:** *Biodiversity, rare plants, conservation, botanical gardens*



## MACROFUNGI OF NATIONAL BOTANIC GARDEN VÁCRÁTÓT

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National Botanic Garden in Vác is a nearly 200-year-old romantic landscape-designed garden, plant collections comprise 13000 plant taxa on 27 hectares.

Mosaic-like structure of the area provides opportunity for a plethora of fungi to colonize different habitats.

In last decade, list of detected macrofungi reached 200 species. List of mycorrhizal species roughly follows the fungal spectrum of oak forests in broad region of the botanic garden. In addition, some host-specialized taxa (e. g. *Suillus* spp.) live sporadically together with the introduced host plants. A remnant white poplar population on alkaline sandy soil presents remarkable mycorrhizal and saprotrophic mushrooms. With the help of trained dogs, fruit bodies of seven subterranean species were found.

Saprotrophic fungi find diverse substrates for colonization. Numerous xylotrophic species are present on the wide range of trees. Some parasitic taxa (*Armillaria mellea*, *Polyporus squamosus*, etc.) cause major problems in protection of old tree collection. On the other hand, three protected species (*Battarrea phalloides*, *Cortinarius paracephalixus*, *Volvariella bombycina*) were listed from the area of Botanic Garden. Tropical macrofungi (*Agaricus blazei*, *Leucocoprinus birnbaumii*, etc.) provide an exotic addition to the richness of fungi in National Botanic Garden Vác.

• **Keywords:** *fungi, biodiversity, macrofungi*



## THE DEVELOPMENT OF LIVING COLLECTIONS IN THE ADAM MICKIEWICZ UNIVERSITY BOTANICAL GARDEN IN POZNAŃ

**Joanna JASKULSKA**

*Botanical Garden of Adam Mickiewicz University in Poznań, Poland, Botanic garden, Poznań, Poland*

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The Botanical Garden of the Adam Mickiewicz University in Poznań was established in 1925. Initially it occupied an area of approx. 2.5 ha. The aim of this poster is to present the development of some of the oldest living collections in the Garden. The first and therefore the oldest sections in the Garden are the Plant Systematic and Plant Biology Sections. The first inventory books hold the information about trees planted even before the opening of the Garden. Some of the listed trees are still alive.

Over the years, the area was expanded several times to fulfill the needs of the developing collections reaching approx. 22 ha.

One of the oldest collections is the *Syringa* collection of cultivars bred mainly by the world-famous French Lemoine nursery. First 50 lilacs were bought in 1932, another 49 were obtained in 1937. Currently the lilac collection reaches 70 cultivars.

The construction of an impressive alpine garden began in the late 1930s. It covers ca. 6000 m<sup>2</sup>, with level difference reaching up to 9 m. 3000 tons of rock material together with seven water reservoirs created a place for mountain plant collection with more than 1300 taxons.

The rose garden was established in the end of 1970s based on the project of Edward Straus from 1931. The revitalization took place in 2014 when the collection was redesigned based on the project of Marta Cyfert, now covering about 30 cultivars of roses. The collections of *Paeonia*, *Hemerocallis*, *Iris* and *Hosta* also deserve special attention.

One of the essential activities of botanical gardens is the maintenance and development of collections for scientific, didactic and educational purposes with available resources and no possibility of increasing the area. The significant aspect of our work is also to preserve historical, oftentimes already forgotten cultivars, which are sometimes not purchasable anymore and to add new cultivars to our collections. It is important to find the balance between preserving the past and the present.

• **Keywords:** *living collections, botanical garden, historical collections*



## PHYTOREMEDIATION DISPLAY FOR BETTER UNDERSTANDING OF PLANT-SOIL INTERACTIONS

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Soil pollution is a widespread problem in the world. In Europe, according to the European Environment Agency, the total number of potentially contaminated sites is around 2.5 million, of which around 350,000 are considered to be highly contaminated.

Various physical, chemical and electrokinetic methods are used to reduce soil pollution, but biological methods, in particular phytoremediation, have recently received considerable attention. This method is relatively inexpensive and environmentally friendly, in most cases does not generate new waste and secondary pollution compared to other conventional treatment methods.

To raise public awareness of the use of plants to reduce soil pollution, the Vytautas Magnus University Botanical Garden in Kaunas (Lithuania) set up a soil phytoremediation display. 8 plots were identified on a 3-acre area, planted with selected plants that can grow in different soil contamination conditions and promote soil remediation. This is a new, non-traditional way of displaying plants, revealing their ability to reduce soil pollution and enabling a better understanding of plant-soil interactions.

• **Keywords:** *Phytoremediation, soil contamination, plant-soil interactions*





## ENDANGERED PLANTS IN *EX SITU* COLLECTION IN BOTANIC GARDEN OF KLAIPĖDA UNIVERSITY

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As of April 2019, fewer than 10% of known plant diversity (28,265 species of plant) was assessed on the IUCN Red List (2019.1). Of these species, over 13,000 (<45%) species are already considered threatened with extinction in the wild (assessed as Critically Endangered, Endangered or Vulnerable). Botanic gardens and other ex-situ facilities such as seed banks are among the most extensive yet underused plant conservation resources in the world. Analysing how well the botanic gardens in their analysis contribute to conservation of plant species, most of Botanic garden and environment specialists used Target 8 from the Global Strategy of Plant Conservation, last updated in 2010, as a yardstick. This target calls for at least 75% of threatened plant species to be included in *ex situ* collections, preferably in the country of origin. Their analysis finds that the institutions represented in the database have already progressed more than halfway towards that target, with 41% of threatened species represented. Compiled in a database, this list consists of national Red List data from 30 European countries and includes over 16,000 country records covering around 9,600 species. One of the most important goal of the Botanic garden of Klaipėda University is to collect native flora and conserve rare species in *ex situ* collections. High number of protected species are cumulated in the new Lithuanian flora, as well as in Medical and species and Ornamental herbal plants collections. In the collections there are 15 species of plants published in the list of threatened European plant species, namely *Linaria loeselii* Schweigg, endemic specie in Germany, Poland, Latvia, Lithuania and Russia (Kaliningrad). *Alopecurus arundinaceus* Poir, *Vicia dumetorum* L., *Cladium mariscus* (L.) Pohl, *Carex magellanica* Lam., *Quercus petraea* (Mattuschka) Liebl., *Betula nana* L. and etc. These are rare, limited populated endemic species of many countries of Europe. From 224 plants inscribed in Lithuanian Red Data book (2019) there grown 47 species of plants. Priority is given to the species, which are on the line of disappearance and which can be saved only by using special safeguards. Some of the plants included in Lithuanian Red List and grown in KU Botanic garden, are for example *Iris sibirica* L. *Salvia pratensis* L., adapted well, self – seed annually and profusely multiply. In our Botanic garden special attention is given to *Eryngium maritimum* L. This plant is a coastal zone species common to Europe, North Africa and Middle East Asia, occurring along the Atlantic, Baltic, Mediterranean and even Black and Azov seas. Around the Baltic sea *E. maritimum* is native in Denmark, Germany, Poland, Kaliningrad region, Lithuania, Latvia, in Estonia near at islands of Skagerrak and Saaremaa, in Sweden near at islands Öland and Gotland. *E. maritimum* populations are found on the Lithuanian coast, only in the Curonian Spit. According to the analysis of the inventory data, in this area dominate vegetative plant sprouts. Since 2019 KU Botanic gardens specialists started conservation and investigation of *E. maritimum* in *ex situ* and *in situ*.

• **Keywords:** *endangered, species, plants, collections*



## EXPERIENCES IN THE EX SITU CONSERVATION OF THE GIANT PLANTAIN (*PLANTAGO MAXIMA* JUSS. EX JACQ.) IN SOROKSÁR BOTANICAL GARDEN

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The giant plantain (*Plantago maxima*) is a highly threatened steppe species of the Hungarian flora. Currently four populations have remained, and are located in the Turjánvidék, Hungary. The characteristic habitat where this species grows is the Pannonian Molinia meadow. Long-term survival of the species is threatened by habitat conversion caused by drainage, the risk of fire, the pressure of invasive species, and the damage caused by herbivores. For species' long-term survival establishment of *ex situ* populations and the development of appropriate guidelines are required. In 2016 we established an *ex situ* collection with three subpopulations in Soroksár Botanical Garden on the natural Molinia meadow site. During the six years period, morphometric data were recorded yearly (leaf length, leaf width and leaf number) and compared with the *in situ* populations. During the studied time frame, based on the morphological parameters, the *ex situ* subpopulations did not diverge significantly from the original populations. The first generative shoot bearing flowers developed in 2019, at one *ex situ* subpopulation and has been continuous ever since. This can lead to the long-term survival of the *ex situ* collection. We evaluated the genetic diversity between the *ex situ* and the natural source *in situ* population (Kakucs) based on eight ISSR markers. The genetic diversity values of the *ex situ* and *in situ* populations were fairly similar (*ex situ*: He 0,206; PPL: 69%; Kakucs, *in situ*: He 0,206; PPL: 72%) indicating that *ex situ* stands have preserved successfully most of the natural genetic variation. Our results suggest that the established *ex situ* population has appropriate genetic diversity and could successfully acclimatized to the novel environment without any signs of morphological changes. This is important also for future reintroduction success. However further collection from all Hungarian natural populations and establishing new *ex situ* living collections is also required in the future to conserve the species' whole genetic makeup in Hungary.

• **Keywords:** *ex situ*, morphometric data, genetic analysis, ISSR



## COLLECTION OF WOODY PLANTS OF THE O.V. FOMIN BOTANICAL GARDEN

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The collection of woody plants of the Botanical Garden has been formed over the past 180 years on an area of 22.5 hectares. Today it has more than 2,224 specimens, which represent 1,140 species. The source for the establishment were the plants transported from the Botanical Garden of Kremenets Lyceum and the Vilnius Medical and Surgical Academy to Kyiv and planted by prof. R.E. Troutfetter.

The arboretum of the Garden is conditionally divided into several sections: Relict woody plants, Pinetum, Decorative woody plants, etc. In the 1960s plant introduction using the method of phylogenetic genus complexes was established in the Garden. It allowed to identify the most stable and promising plants to be used in green building.

The most diverse genera in the Garden's expositions are: *Rhododendron* - 177, *Cotoneaster* - 150, *Spiraea* - 135, *Juniperus* - 76, *Magnolia* - 72, *Crataegus* - 71, *Pinus* - 65, *Lonicera* - 59, *Rosa* - 55 and some others. One of the most famous in Ukraine and abroad is the ancestral complex *Magnolia*, which has more than 70 taxonomic units. Some of the trees of this genus in the Garden date back to 1930. In the 1970s the *Magnolia* Garden was established in the exposition part of the Garden, where more than 100 trees of the Botanical Garden were planted.

The *Rhododendron* complex is well known, comprising more than 170 species and intraspecific taxa from different parts of the world. Scientists of the Garden have developed seed and vegetative methods of reproduction of these plants.

An important part of the Garden's collection is gymnosperm plants (about 320 taxa). This group includes the largest part of rare plants of the Garden. In the collection of the Garden there are old specimens of *Picea abies*, *Pinus nigra*, *P. sibirica*, *P. strobus*, *Taxus baccata*. Currently, the collection includes more than 200 species of protected plants. The collection also includes plants that are over 150 years old: *Acer velutinum*, *Castanea sativa*, *Celtis occidentalis*, *Ginkgo biloba*, *Quercus robur*, *Q. rubra*, *Platanus occidentalis*, *Ulmus pumila*.

The garden is located in the city center, there are unique tree plantations on its territory that have been formed over the past 180 years, which allows to do in-depth research aimed at improving the urban environment.

In 2021, the Collection of woody plants of the O.V. Fomin Botanical Garden was included in the Register of Scientific Objects, which is the National Heritage of Ukraine.

• **Keywords:** *native plants, collection of woody plants, national heritage*



## BOTANICAL GARDENS AS A MEETING POINT BETWEEN SCIENCE AND EDUCATION

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The botanic gardens cover a great range of activities that are expected by the community. The classic scientific and educational activities of botanic gardens look different in implementation when an integrated approach is applied.

The current study aims to present a model for initiating and organizing such activities, based on the experience from the practice of the University Botanic Gardens of Sofia University "St. Kliment Ohridski" (UBG) during the period 2016 - 2021. In order to carry out this activity, an internal university unit called the *Balkan Ecological Center* based at the UBG and managed by a Scientific and Educational Council has been established. During the analyzed period, the staff of the Center focused on several topics: volunteering at UBG; research on different sites of botanic gardens and promotion of scientific results; development of creative and educational activities with the participation of students from different faculties and specialties. The activities are interconnected and form the network of initiatives. The target group is the university students. Each student participates in more than one initiative. For the above mentioned period 49 students from four faculties (biology, medicine, pharmacy, and pedagogy) have participated. A successful model of research group was established: UBG staff, students and scientists, working in a team. Thus, a scientific project for ethnobotanical research on medicinal plants in the North Black Sea coast was completed. Research has been conducted on the flowering walls flora of UBG, herbarium collection, thematic gardens (medicinal plants, sensory garden) and fauna biodiversity inside gardens. "Analysis of the sensory plant collection at the University Botanic Garden – Balchik" proves to be a successful model of research. Different educational activities are organized: poster exhibitions such as "Medicinal plants of the European Pharmacopoeia", held "Outdoor Botanical Laboratory" and etc. All students are also participants in the volunteer initiative, which includes mainly a guided tours and activities in maintaining plant collections. The established model of work during this period lead to forming an academic community with certain consideration to the work and development of UBG, establishing the gardens as a place with a special and unique purpose for students and the university.

• **Keywords:** *university botanic gardens, scientific activities, education activities, volunteering*



## NATIVE WOODY PLANT COLLECTION IN THE BOTANICAL GARDEN OF THE UNIVERSITY OF LATVIA

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To promote the conservation of plant diversity by creating and maintaining living plant collections the objective is to create and maintain collections of woody plants native to Latvia. There are about 120 trees and shrubs species native to Latvia. Accordingly, in the Botanical Garden of the University of Latvia woody plant collection should include about 120 species including 30 species of protected trees and shrubs referred to the Regulations of the Cabinet of Ministers of Latvia No. 396 "On the list of specially protected species and species with exploitation limits" (14.11.2000) and the Red Data Book of Latvia (2003). The limit of 120 species hosting is the area of the garden and the environment required for each species. With that in mind, the aim is to collect and maintain as many species of local origin as it is possible in the Botanical Garden of the University of Latvia. The collection inventory and planning were done to promote achieve the goal. Taking into account the soil, moisture regime, and other environmental conditions of the Botanical Garden of the University of Latvia, it would be possible to supplement the collection with samples of at least 30 species (9 of them are rare and protected), which would have suitable growing conditions in the garden.

The results of inventory showed that there are currently 62 species in the collection, 13 of which are protected: 10 are included in the Red Data Book of Latvia, but 6 species are listed in Cabinet of Ministers Regulations No. 396. However, historically during the development of the collection, a situation has arisen in which some of the species are missing specimens of local origin, or their origin is from nurseries or is unknown. Therefore, one of the goals of the development of the collection is to obtain native origin accessions for as many species as possible. In the last four years, expeditions have been organized to obtain new species, as well as to get the accessions of local origin of the species already existing in the collection, but without proper origin. As a result, the accessions of 14 species were obtained. Several issues have been identified, for example, members of the same family who hybridize to each other and obtain pure specimens is complicated (Salicaceae, Rosaceae), or to obtain propagating material due to the age and condition of the parent plant, so it will be a big challenge to create as complete as possible collection of native woody plants of Latvia.

• **Keywords:** *Native woody plants, endangered plants, ex situ*



## THE NATIONAL PROGRAM ON CONSERVATION AND UTILIZATION OF PLANT GENETIC RESOURCES

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Pruhonice Botanic Garden, Institute of Botany, Czech Academy of Sciences, participates in The National Programme on Conservation and Utilization of Plant Genetic Resources and Agrobiodiversity. Our goals are to ensure sustainable conservation, availability and use of genetic resources important for food and agriculture that are located in the Czech Republic. There are twelve members of the program. Some groups of ornamental plants are also included in this program.

The basic objective of the National Programme is to ensure the long-term conservation of the genetic resources of plants. Appropriate conservation methods are used. The certified methodology Descriptor List for Irises, Peonies and Daylilies in Pruhonice Botanic Garden was created for this program. According to this methodology members provide characterization and gain knowledge of properties, traits, genetic diversity, biological potential and utility value of ornamental plant varieties. Descriptors deals with morphology characteristics (roots, leaves, stems, flowers, pods), biological and horticultural/utility properties. The garden gathers historical, present and new important plant resources originated in the Czech Rep. together with related wild species and relevant breeding milestones.

All data about genetic resources are stored in the Grin Czech database. Evaluation of the project's activities are annually reported to the coordinator, the Gene bank of the Crop Research Institute in Prague. Created reporting system and the database provide the complete state of important plant genetic resources located in the Czech Republic.

The main contribution is, that program's members guarantee the availability of genetic resources included in the National Program. Ornamental plants are stored in the garden for users and provide both the plants and relevant information to domestic and foreign users in accordance with international obligations.

• **Keywords:** *National Program, conservation, Pruhonice, Iris, Peony, Daylily*



## **BALKAN BOTANIC GARDEN OF KROUSSIA AND ZELIOS GI: A CASE STUDY IN CONNECTION TO PARTNERSHIP FOR PLANT CONSERVATION AND RESTAURATION PROGRAMME**

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Balkan Botanic Garden of Kroussia (BBGK-member of BGCI), is supporting as a "system" (Botanic Institution) several activities regarding plant conservation. All these kinds of activities are strong related to scientific research as much as educational programs and both practical and scientific horticultural expertise. Conservation is an important aim regarding priority species but environmental awareness through a nature-based management system is also crucial for the scope of BBGK. BBGK has this kind of activity from day one of its existence. So, providing services to other units with similar orientation through BGCI's accreditation scheme is a part of its role.

Zelios Gi (ZG) is a multifunctional Farm near Gavrolimni (GR) next to the "Rion-Antirion" Bridge, the gate from south to north of Wester Greece. In its unique Nature, several thematic areas compounds a variable ecosystem with "botanical-friendly approach" as management practice. Some of the plant species have uniqueness for the area and need conservation to protect them.

BBGK supports ZG in this frame through the Accreditation Scheme of BGCI so both units proceeding to credentials as Botanic Gardens through plant conservation. In the end of the project, several plant species of ZG would be protected and featured as local "botanical" landmarks through conservation management techniques providing by BBGK. BBGK and Zelios Gi are doing this through the Accreditation Procedure of BGCI to get the credentials of a Botanical Garden in near future.

• **Keywords:** *conservation, biodiversity, accreditation procedure, research, Botanic Garden Conservation International (BGCI)*



## POPULATION SIZE AND DENSITY PATTERNS OF OPHIOGLOSSUM VULGATUM L. IN THE MOLINIA MEADOW OF SOROKSÁR BOTANICAL GARDEN (BUDAPEST)

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*Ophioglossum vulgatum* is a protected fern species of Hungary, observed to have a patchy distribution with high local densities in the Molinia meadow of Soroksár Botanical Garden (Budapest). In this study we estimated the population size and we analysed the spatial pattern of ramet density in the 12 hectares meadow of the garden.

We performed a systematic sampling by dividing the studied area into a 10 m x 10 m sized grid, in the corners of which we placed a total of 844, one meter squared plots. To aid the census, we subdivided each plot into 20 cm x 20 cm grid cells. In each plot we recorded the total number of fertile and sterile shoots. We calculated the spatial autocorrelation of both the fertile and sterile shoot density using Moran's I index, and we used Inverse Distance Weighting to interpolate the number of ramets over the whole area of the meadow.

We recorded a very large number of 7757 ramets across all plots, although they occurred in a relatively low number of plots (133). Our estimates placed the total number of ramets between 7980-70054 over the whole area of the meadow. Moran's I indicated a significant spatial autocorrelation in the density of fertile and sterile ramets, which showed a high spatial overlap.

The large population of *O. vulgatum* enhances considerably the conservation value of the Molinia meadow in Soroksár Botanical Garden. We speculate that the patchiness of soil humidity and chemical properties, as well as biotic interactions might determine the clumped pattern of the ramets in the meadow.

• **Keywords:** *population, spatial distribution, conservation value, rare species*





## HABITAT RESTAURATION OF OLD-FIELDS IN KÖRÖS-MAROS NATIONAL PARK (HUNGARY) WITH IN SITU SEED SOWING AND EX SITU PROPAGATION AND PLANTING OF LOESS GRASSLAND SPECIES

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Nowadays the ex-situ conservation of endangered species has become one of the most important tasks of the botanical gardens because of habitat loss, vulnerability and biodiversity decreasing.

Botanical Garden of University of Szeged (SZTE), carried out a project in the territory of the Körös-Maros National Park (Hungary) from 2017 to 2021, with the following tasks: (1) collection of propagulums from natural loess grasslands, (2) ex situ propagation and plantation of at least 26 000 individuals of 83 rare and protected loess plant species to old-fields with different ages, (3) in situ sowing of at least 280 500 seeds of 33 loess plant species to the same old-fields.

The collection of the propagulums was carried out from 2017 to 2020. The propagation of 75 species was successful, 4 species were not; 31745 individuals were managed to propagate and outplanted. During 4 years of the project 541 724 seeds of 33 plant species was managed to collect. The ex situpropagation of 75 species was carried out from 2017 to 2020 in the botanical garden, with seed-sowing outdoor in autumn or light-chamber in spring.

Nine, partly restaurated former arable fields were chosen as a site of the plantations in four main areas of the National Park. The individuals were planted to the nine sites according to a preliminary determined arrangement; to the angles of a 1,5 m x 1 m grid on the suitable parts of the old-fields. The in situ seed-sowing was carried out in the same arrangement on the same sites. During the outplanting the distribution of the individuals was imitated the spatial pattern of a natural loess grassland community. The plantation and sowing of plants was carried out in October of every year from 2018 to 2021.

Individuals of abundant species (*Phlomis tuberosa*, *Thalictrum minus*, *Filipendula vulgaris* etc.) were planted to every sites, species with low-abundance (*Ajuga laxmannii*, *Peucedanum alsaticum*, *Amygdalus nana*, *Astragalus excapus*, *Althaea cannabina* etc.) were planted to only several sites.

The condition and survival succes of plants will be monitored in the experimental sites in the future.

• **Keywords:** *ex situ conservation, habitat restauration, loess species propagation*



## HORTICULTURAL APPLICABILITY OF *FESTUCA TAXA* (*FESTUCA WAGNERI*, *FESTUCA TOMANII*)

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This survey is connected to OTKA-125423, which examines the vegetation of sandy grasslands along the Danube. During this survey, two potentially horticulturally usable *Festuca* species were analysed: *Festuca wagneri* and *Festuca tomanii*. The main questions were the following: are they usable in an urban environment? Do the species differ significantly? Have they any morphotaxonomic feature which can be utilized in horticultural practice?

Specimens of the two taxa, which were planted either into normal garden soil or into pots differed greatly. Specimens of *F. tomanii* were usually larger and more uniform. Both taxa had the pot treatment well. Though the average lengths of leaves and inflorescence stems tended to be higher on specimens growing in the soil mixed with perlite, but the coverage values were lower; thus adding expensive perlite to the soil might not be rewarding for the farmer.

The two species differed from each other in several morphological parameters. The diversity of *Festuca wagneri* showed well in this survey, and these taxons' parameters would be also useful in horticultural practice.

The work was supported by OTKA K-125423.

• **Keywords:** *Festuca*, grassland, horticulture



## “BOTANIST IN THE KITCHEN”: CLASSIC EDUCATIONAL METHODS ON DIGITAL AND ONLINE PLATFORMS

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In the world of multimedia-based curriculae, it is a great issue that it nearly completely misses the methods of analogue education. Today, online platforms should not be spared at any educational activity. That is especially important at disciplines which use visual identification and presentation heavily. Botany is one of such disciplines. In the past decades foil-using overhead projectors, black-and-white and colour photographs, later digital projectors became part of the education. On top that, interactive education offers new possibilities of self-checking and self-development. Today, lessons in which teachers use traditional blackboards are hardly imaginable. New technology can make the lessons more lively and small details become more visible. Our present material answers these questions and challenges through a series of videos titled „Botanist in the Kitchen”. The first episode (onion) was uploaded to YouTube on 11th April 2019 and it was followed by 113 other videos. The series are still continuing to the present day.

Many episodes were made in natural environment (both in Hungary and Ghana), others in the Eötvös Loránd Science University Botanical Garden, Hungarian University of Agronomy And Life Sciences Botanical Gardens in Gödöllő and Keszthely, and other experiment spaces of the University.

Plant morphology knowledge was built systematically through harmonizing manual drawing with oral presentation. Beyond general morphology, the gastronomic side of plants is also approached. In this way, scientific material and dissemination of information can become more attention-grabbing and entertaining.

• **Keywords:** *YouTube, visual education, gastronomy*



## CITIZEN SCIENCE TOOLS FOR DISTANCE LEARNING OF BOTANICAL CYCLE DISCIPLINES IN THE PANDEMIC TIME AND BEYOND

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Humanity has existed in special living conditions since March 11, 2020 when the World Health Organization declared COVID-19 a global pandemic. This coronavirus disease has already taken more than 5.7 million lives from almost 389 millions of officially confirmed cases of people infection around the world on February 4, 2022. Nobody knows when the pandemic will stop, because new variants of SARS-CoV-2 appear constantly. Even population vaccination around the world has not given sufficient effect yet that it would be possible to return to normal life. Lot of researchers, university lecturers and teachers are concerned by new challenges in the education and science process. Volunteers and specialists of plant science and botany are getting older and the decreasing number of junior scientists gives a pessimistic view of conservation of plants. Therefore, many new recommendations and methodologies have been published for effective teaching in the pandemic time focusing on different forms of distance digital education. Certainly, the process has been actual for biological disciplines too where the biggest problems appeared with the organisation of field courses. Every country and even every university has been looking for optimal ways within their epidemic situation according to country restriction rules. So, we have generalized this experience, as well as it has been developed a protocol on example iNaturalist platform (<https://www.inaturalist.org/>) for effective using of citizen science tools not just for distance learning of botanical cycle disciplines in the pandemic time and beyond, but also for collecting valuable data about plant distribution during this process. We present a future-oriented vision of the solution of biodiversity and sustainability education.

• **Keywords:** SARS-CoV-2, pandemic, botany, field practice, distance education, citizen science



## PROTECTION OF PLANT SPECIES AND THEIR GENETIC RESOURCES. DIFFERENT SPECIES - DIFFERENT METHODS THE COLLECTION OF PROTECTED, RARE, ENDANGERED AND VALUABLE PLANT SPECIES FOR THE PODKARPACIE REGION

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The living collection of rare, endangered and protected plants has existed since the Bolestraszyce Arboretum was created in 1975. Among the cultivated species, there are 95 under legal protection (56 under strict protection, 39 under partial protection) and 75 species placed in the *Polish red list of ferns and flowering plants*, including: 2 extinct within Poland, 1 extinct in the wild, 14 critically endangered, 12 endangered, 29 vulnerable and 17 near threatened.

The four-leaf clover *Marsilea quadrifolia* L., extinct in Poland, has been cultivated *ex situ* in the collection since 1987. *Prunus fruticosa* Pall., a species vulnerable, has been preserved in the collection as well and is currently being reintroduced to its historical locality in Przemyśl (Winna Góra distr.). This species has attracted considerable interest due to its edible and tasty fruits, which have been researched in terms of its physical and chemical properties.

The aim of the collection is to gather plants which are particularly valuable for the region of Podkarpacie, located in the south-east of Poland. In the Cisowa branch of the Arboretum, established in 1996, the protection of the vulnerable species *Cirsium decussatum* Janka has been protected actively in its natural habitat. Also, plant species from the genus *Rubus* L., growing in the Podkarpacie region, have been collected in the Cisowa branch since 2016.

The plant selection was extended to include plant species that are extremely valuable throughout the country, due to the educational nature of the collection. The collected plants are presented in several ecological groups throughout the Bolestraszyce Arboretum.

Plants for the collection are obtained via plant and seed exchanges directly among botanical gardens, seed exchanges through the Index Seminum and, occasionally, from natural habitats.

• **Keywords:** *Bolestraszyce Arboretum, Cisowa Arboretum, rare and protected plants, reintroduction, natural habitat*



## PROTECTION OF PLANT SPECIES AND THEIR GENETIC RESOURCES. DIFFERENT SPECIES - DIFFERENT METHODS THE POMOLOGICAL COLLECTION OF HISTORIC VARIETIES OF APPLE TREE, *MALUS MILL.*, PEAR TREE, *PYRUS L.*, AND CORNELIAN CHERRY, *CORNUS MAS L.*

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Arboretum and Department of Physiography in Bolestraszyce was established in 1975. It covers an area of 28 ha in Bolestraszyce and area of 280 ha in Cisowa (since 1996).

The pomological collection was established in the late 1980s to preserve and protect old varieties of fruit trees. The starting material for setting up the apple tree collection came from extant old orchards. In 2002 an inventory of the pear tree collection was carried out in the Podkarpackie region and the material for grafting old pear varieties was selected. In 2004, the pomological collection was incorporated into the National Centre for Plant Genetic Resources in Radzików. The Bolestraszyce orchards boast a collection of 1,374 apple trees and 632 pear trees over a total area of 8 ha. 400 apple trees are growing at Cisowa. In order to evaluate the ecotypes and varieties and the suitability of selected fruits for processing into specific products, laboratory tests were carried out at the Department of Fruit, Vegetable and Nutraceutical Technology of the Wrocław University of Environmental and Life Sciences. Between 2013-2020, the laboratory tested 141 ecotypes and varieties of pear and apple fruit, as well as many products produced in the Arboretum. The content of dry matter, extract, sugars, organic acids, pectin, ash, vitamin C, polyphenols, carotenoids, and triterpenes was determined and the antioxidation properties were assessed by three tests DPPH, ABTS and FRAP.

The edible cornelian cherry collection was established in the 1980s by collecting Polish ecotypes. 117 cultivars and ecotypes of *Cornus mas* L have been gathered. The collection consists of 2470 shrubs. Between 2008-2017, the first 12 Polish cultivars of *C. mas* L. ('Bolestraszycki', 'Dublin', 'Juliusz', 'Florianka', 'Kotula', 'Kresowiak', 'Paczoski', 'Podolski', 'Raciborski', 'Stowianin', 'Swietłana', and 'Szafer') were selected. Traditional products are made from fruits of cornelian cherry according to traditional recipes. University research conserves such areas as the production of innovative cornelian cherry-based products, the possibility of using its supplements, or products in the prevention and treatment of cardiovascular diseases or osteoporosis.

The Arboretum has put great effort to popularize knowledge about the pomological collection.

• **Keywords:** *Bolestraszyce Arboretum, pomological collection, Polish cultivars of cornelian cherry, historic varieties*



## MICROPROPAGATION ACTIVITIES IN THE ELTE BOTANICAL GARDEN (1986-2021)

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The laboratory of ELTE Botanical Garden has started to work in 1986. Our primary aim was the asymbiotic seed sowing and growing of tropical and subtropical orchids and so to increase the collection of Botanical Garden and to preserve several rare and endangered species. The modified FAST culture medium proved to be the best among several others (Szendrák, E., R. Eszéki, E., 1993). For further culture of tropical orchids modified KC medium have the most positive effect (R. Eszéki, E., Györfvály, A., 2000). Over the decades adapting to the needs of different botanical species we applied in the media activated charcoal, growth regulators (NAA, IBA, BAP) and vitamin sources (Yeast extract, B vitamin complex), peptone. We applied for increase efficiency of breeding by supplement the basal medium with natural origin complex additives: coconut milk, potato, maize, Jerusalem artichoke (R. Eszéki, E., Tilly-Mándy, A., Forrai, M., 2009). We have started to focus on the propagation from seeds of hardy orchids, since 1988. In the case of 19 native Hungarian species the most successful among the examined media was a modified Fast medium (R. Eszéki, E. et al., 2016). In addition in our laboratory we've dealt with clonal propagation of *Phalaenopsis* hybrids from flower stalk; different vanilla species and 'jewel orchids' propagation using *in vitro* techniques, stock maintenance and propagation of carnivorous plants. In terms of university education, partly the laboratory is a practical place as well, and on the other hand we give topics of dissertations for students. Occasionally for the visitors we keep presentation about the work of the laboratory as part of an organized guidance. Our purpose is to improve the efficiency of orchids '*in vitro*' propagation and to apply successfully our experiences in the education and to disseminate knowledge for the public.

• **Keywords:** *in vitro* culture, orchids, complex additives of natural origin, university education, presentation for visitors



## THE GHENT UNIVERSITY BOTANICAL GARDEN: TOWARDS EXPERTISE CENTRE OF *MAGNOLIA* RESEARCH FOR CONSERVATION

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The Botanical Garden of the Ghent University, Belgium, was established in 1797 and has since developed into a botanical treasury. The garden is just a stone's throw from the city centre. It occupies 2,75 ha and is home to ten thousand taxa. The garden sits next to the Faculty of Sciences and inspires both students and research teams to collaborate on the study of living plant collections. Since approximately 15 years, the scientific staff associated to the garden has carried out research focusing on understanding diversity and evolution of specific plant groups in the tropics, most of which are represented in the plant collections. A considerable portion of this material was collected by us during extensive field work in the Neotropics, as a consequence of which we also became interested in the conservation status of our study groups. Therefore, in addition to traditional taxonomic and phylogenetic studies, we carry out research that supports concrete conservation of threatened species on the ground. We currently focus on Neotropical *Magnolia*, with many highly endemic and Vulnerable, Endangered or Critically Endangered species, according to recent assessments for the IUCN Red List. Nearly all these species are absent from *ex situ* collections anywhere in the world, and most of them are not included in any *in situ* conservation actions. Considering that the habitat of a significant number of these taxa is continuously declining because of deforestation and land use change, urgent conservation actions are needed. Efficient *in situ* and *ex situ* species conservation management plans require information on genetic diversity at species and population level, i.e., the units of conservation. Since nearly ten years, the Ghent University Botanical Garden has grown into a centre of expertise, providing genetic data supporting effective *Magnolia* conservation in the Neotropics. Results already obtained are being used in conservation programs in southern Mexico and the Caribbean.

• **Keywords:** *Magnolia; conservation; neotropics; biodiversity*





## EDUCATIONAL STRATEGIES AT BUDAPEST ZOO AND BOTANICAL GARDEN

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Hungary's civilian garden culture lags far behind the Western European average. Since the beginning of 2021, the spread of „home office“ helped in the educational process, because it has increased the demand for plant keeping among the young population.

In Budapest Zoo and Botanical Garden we disseminate horticultural knowledge in six areas:

Targeted posts on social media, Daily continuous horticultural activities, Internal and external attitude-forming videos, Special events: night at the Zoo, guided tours, related to professional training, field practice, lectures, Intermediate and advanced internship program

We have a horticultural program for children called „légy ott“ (be there). As required the program can be changed to better fit high school students or adults thanks to the trays that we keep in our cabinets.

For the holidays we also organize programs for campers. We teach the basics of landscape architecture, East Asian flora and Japanese culture, and we also present special plants.

Our bonsai exhibit is a guided presentation of different types of bonsai together with irrigation, and after that there is an interactive presentation between the visitors and us.

The presentation of poisonous plants and the relevance of Hungarian peasant culture happens after closing. In our experience the visitors are much more interested in longer and more detailed presentations after closing hours.

Our task book consists of two parts: one for the educators, and one for the students.

On our website every week we share short educational materials in botanical themes. We also post on our social media platforms with dual purposes. On one hand, we would like to awaken some curiosity in those whom have not had many interests in plants before, on the other hand we would like to serve substantial information to those whom are already well versed in the profession.

As a botanical garden integrated into a zoo, we had more than 150 years to show the botanical values to those who only came for the experience of the zoo. Next to the very serious zoological work (that mostly happens in the background) there is a tradition of botanical work as well. Emphasizing this and allowing people to take a peak into the work we do „behind the scenes“ helped us achieve a million visitors annually, which ultimately helped us form the attitude towards horticulture. The chart shows well that although

our botanical themed posts are a bit less popular, compared to the average Hungarian botanical contents, it performs very well.

• **Keywords:** *education, social media, horticulture, botanical program*



## THE NEED TO MONITOR THE SPONTANEOUS FLORA OF BOTANICAL GARDENS AND ARBORETUMS TO STUDY THE OVERALL DYNAMICS OF REGIONAL FLORAS OF UKRAINE

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Monitoring of the spontaneous flora of the centers of plant introduction (botanical gardens and arboretums) is important in the general study of regional flora and phytointroductions. In the centers of plant introduction, the group of escaped plants is the most diverse, and is constantly replenished.

In M.M. Gryshko National Botanical Garden (Kyiv, Ukraine), about 5000 species of ergasiophytes are cultivated on an area of 120 hectares, and 729 wild plants are part of the spontaneous flora, of which 173 are escaped plants (2021 data). More than 400 species of ergasiophytes form self-seeding within the collection plantations. For the first time in the central part of Ukraine it was in M.M. Gryshko National Botanical Garden we recorded random habitats of *Acalypha australis*, *Anthriscus caucalis*, *Hordeum bulbosum* and others. Outside the botanical garden escaped from the culture: *Celtis occidentalis*, *Clematis vitalba*, *Mirabilis nyctaginea*, *Phytolacca acinosa*, *Reynoutria bohemica* and some other plants. Among the 37 invasive plants in the botanical garden, the most harmful are: *Acer negundo*, *Clematis vitalba*, *Heracleum sosnowskyi*, *Parthenocissus vitacea*, *Solidago canadensis*, *Vitis riparia* – all escaped plants, including 3 lianas.

It should be noted that successful naturalization also occurs in some plants from the Red Book of Ukraine, for example: *Muscari botryoides*, *Ornithogalum boucheanum*, *Taxus baccata*.

Similar tendencies are observed in smaller centers of introduction. For example, in the Syretsky Dendrological Park of National Importance (Kyiv), more than 1300 species of ergasiophytes are cultivated on an area of 7,5 hectares. At the same time, more than 420 wild plants were recorded in the spontaneous flora, including more than 100 escaped plants. *Parietaria judaica* and several other xenophytes were found here for the first time in Kyiv. *Acer negundo*, *Berberis aquifolium*, *Celtis occidentalis*, *Clematis vitalba*, *Parthenocissus vitacea*, *Phytolacca acinosa*, *Reynoutria bohemica* and *Vitis riparia* show high invasive activity.

Thus, the spontaneous floras of botanical gardens and arboretums are extremely dynamic formations, but their structure and composition of invasive plants are generally similar. Their study is important for understanding the processes occurring in the vegetation cover.

• **Keywords:** *spontaneous flora, escaped plants, phytointroductions*



## REVITALIZATION AND DENDROFLORA IMPROVEMENT OF THE BOTANICAL GARDEN JEVREMOVAC

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Botanical Garden "Jevremovac" is located in the centre of the City of Belgrade, the municipality of Stari Grad. It spreads over approximately 5 ha (4.8183 ha) and is divided into 14 thematic plots. In 1995, the Government of Serbia passed a decree declaring the Botanical Garden "Jevremovac" a natural asset - a Natural monument of great importance - category II. Remediation and revitalization project of the *Jevremovac* Botanical Garden - within the project "Plan for the management of protected natural assets *Jevremovac* Botanical Garden", included analysis of the cadastre of dendroflora and updating the existing bio-ecological plan with analysis of the existing state of greenery. We've developed very concise and straightforward manual for the remedial treatments for the existing trees. Based on the collected information, a conceptual solution for the revitalization and improvement of the dendroflora of each individual plot was made, with the proposal for a planting plan and inclusion of potential new species. Special attention was given to including the endemics, rare and threatened species into the collection, as well as replacement of the lost autochthonous species. 16 zones were made throughout the Botanical Garden, including but not limiting to current thematic plots. 7 new, and improved landscape designs, with planting plans, were made for enrichment of the Garden's offer. All areas were considered from the visitor's point of view, and the accent was put to educational content. One of the highlights was adding an educational collection consisting of the autochthonous edible dendroflora from the ROSACEAE family and specially designed Food forest. Whole project was designed as a collaboration between botanists, vegetation ecologists, plant production specialists and landscape architects, and resulted in textual analysis, accompanying technical documentation with updated GIS database, and landscape designs and planting plans for the new areas.

• **Keywords:** *Revitalization, Endemic species, Food forest, Education*



## DIGITISATION OF THE DBN HERBARIUM AT THE NATIONAL BOTANIC GARDENS OF IRELAND

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The National Herbarium (DBN) at the National Botanic Gardens of Ireland houses a growing collection of more than half a million specimens of plants and fungi from Ireland and around the world. The collection comprises of historical specimens collected between the early 19th century and the present day. The DBN collection is therefore important from the perspectives of cultural and natural heritage. It is a valuable resource for science and education, and for understanding the natural world. The specimen data provides records of spatial and temporal changes in the Irish flora. In 2021, a herbarium digitisation programme was established at DBN with an initial focus on digitising the Irish collection (c. 100,000 specimens) and specialised collections of historical importance (e.g. the Robert Brown and McNab herbaria). We created a viable workflow specific for DBN, modified from iDigBio recommendations. Our imaging station consists of a mirrorless interchangeable lens camera mounted on copy stand with LED lighting. This workflow enables specimens to be imaged at an average rate of 50 sheets per hour. Our future plan includes using crowdsourcing to transcribe specimen labels and subsequently making the data and images available online through a web-based collection management system.

• **Keywords:** *Herbarium, digitisation, Irish flora, DBN*



## PLANT GENETIC RESOURCES IN VILNIUS UNIVERSITY BOTANICAL GARDEN

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Nowadays botanical gardens are seeking to play a key role in conservation of the world's plant diversity. A number of botanical gardens are working together or in collaboration with other institutions in order to coordinate and target their conservation activities. The biggest treasure of any botanical garden is its plant collections. In terms of the size of these collections, Vilnius University Botanical Garden is the largest in Lithuania and one of the largest in the Baltic States. As of 2021, plants of over 10 000 taxa are grown in Vilnius University Botanical Garden. They include 23 plants listed in the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species; 37 plants listed in the Lithuanian Red List; 1972 plants listed in the Botanical Gardens Conservation International (BGCI) database; and 454 plants listed in the Lithuanian Ornamental Plant Genetic Resources database. Two other plant collections in Vilnius University Botanical Garden have Lithuanian Ornamental Plant Genetic Resources status: *Ribes nigrum* L. and *Ribes uva-crispa* L. collections. Researchers of Vilnius University joined the programme for investigation and conservation of genetic resources in 1994. Lithuanian flower breeders released a lot of new cultivars of *Dahlia* Cav., *Gladiolus* L., *Hemerocallis* L., *Iris* L., *Lilium* L., *Paeonia* L., *Primula* L. and some others. One of the aims of the staff of Vilnius University Botanical Garden is to collect, investigate, evaluate and describe new cultivars. At present, there are about 500 flower cultivars developed by Lithuanian plant breeders in the collections. The Lithuania Ornamental Plant Genetic Resources Coordination Center was established at Vilnius University. The Government of the Republic of Lithuania decided to establish the Plant Gene Bank in 2004 and later adopted the Resolution to reorganize the Plant Gene Bank by connecting it to the Lithuanian State Forest Service.

• **Keywords:** *plant collections, plant genetic resources, cultivars*



## ART AND CULTURE IN THE NATIONAL BOTANIC GARDEN

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*National Botanic Garden Vácrátót, Vácrátót, Hungary*

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The National Botanic Garden is located in Vácrátót village – worthily - a historical garden with 200 years of past. Having been open for the public for more than 70 years the garden provides inspiration, a place, a theme and a program for art lovers and artists, as well as an opportunity to relax.

The former chateau garden is accompanied by different eras of landscape gardens, starting from the romantic style at the time of its flourishing. This period is marked by the folly, the watermill, the rock tunnel and the wrought-iron gate.

From the beginning (1961) we have organized classical music concerts every year. In connection with the tradition, we also erected a sculpture at the Great Pond, from one of the most significant XX. century Hungarian sculptors.

Our new series of programs is Garden on the CuBE (Culture-Botany-Ecology) the Institute's researchers offer a cocktail of science and culture. Interactive programs, lectures and conversations, concerts characterize the series of events launched with the intention of creating tradition.

The 1st Open Workshop for Nature Arts started in 2021 in cooperation with the Hungarian University of Fine Arts resulting in works of art made of local materials locally. Sculptor students reflected on the themes of responsibility for the natural world, using our garden as inspiration and as a creative and exhibition space. A temporary exhibition has been created where the works enhance the experience of garden walking in harmony with the natural environment.

Keeping younger generations in mind, our creative competition for children has been announced for years. with incoming entries in various botanic garden and natural topics. The Watercolor Painting Course for amateurs has also been held for years under the guidance of an art teacher. The session provided an opportunity for calming down and engrossment, while participants were able to learn the tricks of painting. We are planning to restart both.

• **Keywords:** *art, culture, concert, researcher, sculptor*



## EDUCATIONAL, GARDENING PROGRAMMES FOR CHILDREN IN EÖTVÖS LORÁND UNIVERSITY BOTANICAL GARDEN

**Zsuzsa SZAKACS-NAGY**

*Eötvös Loránd University Botanic Garden, Budapest, Hungary*

Environmental education of children by practical gardening programmes, innovative teaching methods, experience-based learning (learning by doing) and player education (teaching by playing).

### **Our Vision**

We believe that every child needs to get involved in gardening.

Our vision is to change the philosophy of children – and with their intermediation the philosophy of their parents – with playful gardening, in order to create a greener, more environmentally way of life, where they value the organic vegetables from the backyard, produced with their work and where they enjoy the creation from grass, wood, flowers, and recycled materials.

### **Our Mission**

The practical playgroups motivate the kids to protect nature and their fragile environment, nurture healthier and think creatively. We create opportunities for kids to play, learn, and grow through gardening.

### **Our past**

The Eötvös Loránd University Botanical Garden has been organizing environmental education programmes for children, gardening classes for preschool and school groups and families for several years.

In 2013 was founded the Szamóca (Strawberry) Gardening School for children.

In 2014 we announced regular programs in the ELTE Botanical Garden in Budapest on kid's klub for children, ages 3-10 years and workshops for groups from kindergartens and schools.

Since 2015 every year, we have organized programmes for school groups about composting, with the cooperation of the Environmental Fund of Budapest.

In 2017 was founded the "FűFa Tankert". The infrastructure of the gardening school was built on a new place in the ELTE Botanical Garden. Raised beds, planting tables, shed for instruments and a covered terrace was built to provide an ideal place for kids gardening programmes. Since the handover, we have received the kids from all of the kindergartens from the local district, in the framework of cooperation with the local government.

In 2019, 80 preschoolers groups 1,900 children from Józsefváros district of Budapest, took part in interactive sessions with optional topics.

In 2021 we continued our programmes for families, and started again the cooperation with the local district (Józsefváros).

### **Our future**

In 2022 we will build a gardening school in Göd–Huzella Garden – (this site, belongs the Eötvös Loránd University Botanical Garden and we will start the programmes in spring there.

• **Keywords:** *environmental education, gardening classes for children, experience based education, teaching by playing*



## BE INSPIRED! INTERACTIVE EDUCATIONAL ACTIVITIES AT BOTANICAL GARDEN OF ESZTERHÁZY KÁROLY CATHOLIC UNIVERSITY (HUNGARY)

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There are many different ways how botanical gardens can perform the task of environmental education. We would like to show the most interesting and exciting activities, we carry out, especially for schoolchildren. The poster presents didactic games, competitions, scavenger or treasure hunts and specially prepared workshops. Every educational activity is described in detail with required tools or material, and supplemented by photos. Teaching through games – a vision of John Amos Comenius – is still very actual and the botanical garden is the most appropriate place, where a new knowledge could be absorb nearly unintentionally and spontaneously. According to our experience, a botanical garden environment has a relaxing effect on people and they are more open to new, interesting facts and feelings. In process of deepening the classical knowledge, all the senses are stimulated: to see, to touch and to feel the plants can be an extraordinary experience. The group-works usually enhance cooperation and partnership and in this way we can involve nearly every children into the exploration of the garden.

• **Keywords:** *teaching throw games, education*





## SUSTAINABLE SOCIAL PRACTICES AND TRADITIONS IN AN ARBORETUM BASED ON ECO-FRIENDLY ATTRACTIONS

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Can an arboretum be simultaneously a botanical garden and an ecological park? The purpose of this research is to present the connection between the sustainable conservation and development of the social practices and traditions in botanical gardens and the organization of environmentally oriented attractions and events in park areas. The definition of the International Union for the Conservation of Nature (IUCN) states that ecotourism is the "environmentally responsible visiting of relatively unspoiled natural areas in order to enjoy and appreciate nature...". The University Botanic Garden – Ecopark Varna operates as the first ecological park in Bulgaria and on the Balkans. It has been designed as a typical arboretum comprising over 330 species of native and introduced trees and shrubs. It is a tourist site of regional significance and during its 20-year development Ecopark Varna launched many eco-attractions of cultural, scientific-educational, sport and entertainment nature. In its joint work with local organizations and educational institutions, the garden organizes "green school" environmental camps that direct the attention of the pupils towards environmental conservation and strengthen their sense of responsibility towards nature. The guided walks and botanical consultations showcase the natural and manmade ecosystems in the park, increasing the visitors' knowledge about the significance of the biological diversity in the area. The offered instructor-led lessons in horseback riding and the staged tournaments in equestrian parkour enhance the sport culture of children and adults. The celebrations of national and folk holidays, the designation of recreation zones, the rides in a traditional decorated Bulgarian carriage and the organization of folk wedding ceremonies in the park area help the visitors get closer to the traditional Bulgarian family values.

Due to their cultural, entertainment and social nature, the organized eco-attractions in the arboretum bring thousands of visitors each year. In this manner, by maintaining the traditions and the social practices, Ecopark Varna accomplishes also one of the key missions of botanical gardens, namely the conservation of the world biodiversity together with the increase in its visitors' awareness of the significance of botanical gardens.

• **Keywords:** *eco-attractions, botanical garden, arboretum, ecological park, social practices, traditions, recreation, biodiversity*



## SURVEY OF THE LARGEST TREES IN THE ARBORETUM OF SZARVAS

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The aim of the studies is to carry out a detailed survey of the largest and oldest trees of the Arboretum of Szarvas, to determine their species and genus distribution.

The size of the trees was determined on the basis of two characteristic and well-measured parameters, one being the trunk circumference measured at a height of 130 cm and the other being the height.

The trees selected for measurement are located in the oldest part of the Arboretum, the 150-year-old Pepi Garden, home to the oldest and largest trees in the 82-hectare collection.

Our study included the comparison of the growth of native and non-native species. In addition to native and typically long-lived, large-bodied species, we wanted to see if non-native species reach the same size in the extreme continental climate of the Great Hungarian Plain?

The survey results show that the 20 trees with the largest trunk sizes represent a total of 10 species, four of which (*Quercus robur* L., *Populus nigra* L., *Populus alba* L., *Ulmus glabra* Huds.) are native to Hungary and six are non-native (*Platanus x hispanica* Münchh., *Pterocarya fraxinifolia* (Lam.) Spach., *Quercus alba* L., *Quercus palustris* Münchh., *Quercus rubra* L., *Sequoiadendron giganteum* (Lindl.) J. Buchh.). This indicates that exotic species are also surprisingly well adapted to the extreme climatic conditions of the Great Hungarian Plains and are capable of reaching a considerable age and stature. The above confirms that it may be worthwhile to plant and study more non-native species in the Arboretum, as it seems that they can be a long-term element of ornamental gardens or public parks in such climatic conditions.

• **Keywords:** *native, non-native, extreme climate, old trees*



## BUCES PROJECT: URBAN BIODIVERSITY AND CITIZEN SCIENCE IN PRIMARY SPANISH SCHOOLS

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The BUCES project is an innovative and dynamic project cataloguing the biodiversity of thirty primary schools around Spain with a citizen science program. The project brings scientists, technicians, teachers and students from thirty primary schools in Spain working in urban biodiversity together to share knowledge and expertise.

The main objectives of the project are:

To promote and increase interaction between scientists, primary school students and teachers.

To promote research and knowledge in biodiversity, and to develop effective solutions and best practices to protect and increase the value of urban biodiversity in primary schools.

To develop an understanding of the way sciences work (protocols, monitoring methodologies, biological recording works, etc...).

To perform an exhaustive survey and a diagnostic evaluation of the biodiversity in Spanish primary schools.

To encourage and develop an interest in science in the participating students.

The taxonomic study groups with the citizen science program are:

Vascular plants: to study them, the students make specimens of plant material and take photos (flower, fruit and the plant) to provide a resource to identify the specimens.

Arthropods: they are caught by pitfall trapping, Moericke traps and insect houses. The samples are photographed by the students and sent to scientific collections to be verified.

Birds: the students learn to draw birds through watching them and make a field notebook to help them to identify them.

The biodiversity samplings are done with BioBlitz (a participatory search for species in a limited area in a limited timeframe) organized in the thirty participating schools with students, teachers, wildlife experts and scientists.

All the biological and environmental data recorded are in iNaturalist, a platform where anyone can record their observations of nature.

• **Keywords:** *Citizen Science, BioBlitz, vascular plant, arthropod, bird, school*



## SUSTAINABLE GARDENS IN SCHOOLS IN MADRID, SPAIN

**Clara VIGNOLO & Silvia Villegas NAVARRO**

*Real Jardín Botánico, CSIC and Fundación Española para la Ciencia y la Tecnología (FECYT)*

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School grounds provide a perfect opportunity to introduce students to gardening and biodiversity in a practical way. The Project "Sustainable gardens in schools" is establishing sustainable gardens in five centers (three primary schools and two secondary schools) in Madrid, Spain through an educational program that involves teachers, students and technicians.

The aims of the project are:

To increase the ecosystem services in the schools improving the landscape, air quality and increasing the number of plants and animal species.

To increase the urban biodiversity by planting new plants and providing habitats for wildlife, installing bird feeders, bird boxes and bug hotels.

To create an outdoor learning area to study biodiversity and environmental issues.

To get students actively involved in nature conservation and to develop effective solutions and best sustainable practices in the schools and cities.

To high light the importance of nature in the school grounds and to encourage the care of them and the landscape and the surrounding areas.

The project is carrying out a series of workshops and lectures with teachers and students participating that provides them with enough skills to establish a garden in the school grounds from the beginning.

The first lecture gives an introduction to the teachers about how to produce a concept document or how to draw a simple plan for a new garden. During the second lecture the teachers learn about the soil and the importance of it to grow plants. They learn a series of experiments that they can reproduce in the class. The third lecture introduces them to the Mediterranean plants and their uses in gardening. It shows a number of different types of planting from trees to herbaceous plants. In the fourth and fifth lecture they study the urban fauna, how to identify them and how to provide habitats for wildlife. And finally the last lecture is about plant propagation and seed banking.

All together the project sets a guide to establish sustainable gardens in school grounds in a Continental Mediterranean climate like Madrid.

• **Keywords:** *Sustainable gardens, biodiversity, shool grounds*



## EXPERIENCE NATURE FIRST-HAND OR EDUCATIONAL ACTIVITIES IN THE PRAGUE BOTANICAL GARDEN

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*Prague Botanical Garden, Education Team, Prague, Czech Republic*

The Prague Botanical Garden is one of the educational institutions that offers the general public the opportunity to experience nature first-hand.

Nature is the perfect classroom that offers students of all educational institutions and ages the opportunity to complete programs in an environment that is not comparable to a traditional school classroom. Students are engaged in programs where they gain hands-on skills and knowledge that they can then apply in the classroom. Often, children who would otherwise have been left out or left behind in the educational process also have the opportunity to make their way.

The programs we offer to educational institutions take place in the Fata Morgana greenhouse, outdoor expositions, wine production exposition, and in a laboratory classroom. Programs focus not only on interesting facts about the plant kingdom, but also on practical skills and they try to stimulate an interest in nature and environmental protection in students.

Another educational activity that the garden has also offered to children since 2010 is the opportunity to spend their free time meaningfully during the summer holidays. Summer camps are designed for children aged 6 to 14 and they take place in the garden. They introduce to children the attractions of the outdoor expositions and of the tropical Fata Morgana greenhouse. We also offered an exploration-oriented camp last year.

Our botanical garden also plays an indispensable role in the education of adult visitors. Through our guides, we offer the opportunity to take a guided tour on a chosen topic. The tours take place in the Fata Morgana greenhouse, the outdoor expositions and the wine production exposition. In addition, during the winter months, visitors can take a unique guided tour through the darkened tropical greenhouse to experience the atmosphere of the tropics at night.

• **Keywords:** *experiential learning, summer camps, laboratory classroom, garden, ecology, adult education*



## PLANT ADAPTATION EXPERIMENTS IN THE KECSKEMÉT ARBORETUM IN EXTREME CONDITIONS (OF CLIMATE AND SOIL)

by Istvánné Sipos, Mónika Vörösváczki (2022)

**Mónika VÖRÖSVÁCZKI**

*KEFAG Kiskunsági Forestry and Woodworking Private Limited Co., Kecskemét Arboretum, Kecskemét, Hungary*

### Introduction:

- Arboretum of Kecskemét is a 35 year old plant collection, replacing a former cornfield and vineyard.
- This is a woody plant collection with more than 900 taxa on a 62 hectare area.
- Foundation, maintainance: by a forest company (owned by the state) named Kiskunsági Erdészeti és Faipari Zrt. (KEFAG)
- The nature of the maintenance: extensive (irrigated occasionally for 3 years after planting)
- Year of plantation: in progress since 1986.
- Admission: free

Objective: Arboretum of Kecskemét is an interesting place for experiments of adaptation. The annual precipitation is low, climate is continental, the soil is diverse, rather sandy so it is a good place to show us which woody plant is perspective to plant into the nearby gardens. A meteorological observation station and former soil exploration help us to draw the conclusions.

### Methodology:

- Annual monitoring, taking into account not only climatic data but also soil conditions.
  - The plants are registered with a GIS software called QGIS. Recorded data: name, code, year of planting, origin. Number of our plants from the original habitat: 149
- The different overlays show many other information on the map such as soil type, exposure, etc.
- Our meteorological station is part of a nationwide meteorological network called "Időkép", but we also perform manual measurements (of precipitation)
- (The current data can be seen on our website: [www.kecskemetiarboretum.hu](http://www.kecskemetiarboretum.hu))

### Results, conclusion:

- Plants that, in our experience, can be recommended in this region: *Cedrus libani* var. *stenocoma*, *Parrotia persica*, *Prunus serrulata* and its cultivars, *Malus* sp., *Pyrus* sp., *Crataegus* sp. and so on.
- From the point of view of adaptation experiments, it is still worth observing the plants from the original habitat.
- A particular taxon should be planted in different soil types, into different microenvironment.
- One should not give it up, it is worth trying to plant special taxas for several years.

### Source:

Peter Víg (2001): The climate of Kecskemét Antal Gőbölös (1996): The history of the birth of the Kecskemét Arboretum András Bidló – Gábor Kovács (2001): Soil conditions of the Kecskemét Arboretum Időkép Kft. (2017-): Data of the meteorological station of the Kecskemét Arboretum

- **Keywords:** *adaptation, Kecskemét Arboretum, Kecskemét, forestry, KEFAG, Kiskunsag, plant collection, experiment, continental, introduction*



## EFFECTS OF THE PANDEMIA IN KECSKEMÉT ARBORETUM (EVENTS, VISITORS, PLANT COLLECTION)

by Istvánné Sipos, Mónika Vörösváczi (2022)

**Mónika VÖRÖSVÁCZKI**

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### Location:

- Kecskemét is a county seat with about 110 000 inhabitants, 86 kms South of Budapest.
- The arboretum is an important part of the greenbelt close to the city centre.

### Features:

- A 35 year-old plant collection, on the site of a former cornfield and vineyard. This is a woody plant collection with more than 900 taxa on 62-hectare area.

Foundation, maintenance: KEFAG Plc.

Admission: free

Tourist attractions

1. On state owned land: plant collection, a new look-out tower, wooden playground

Thematical experience-based events for children and guided programmes for adults annually.

"Where are you Kajla?" – a promoting hiking for children (organized by the Hungarian Tourism Agency <https://kajla.hu/kajla-korok>)

2. On church owned land (cultural heritage):

The 2-hectare Church area is an organic part of the Arboretum.

On site:

- Maria Chapel (built in 1718.) This chapel has been a shrine for pilgrimage for centuries.
- Ally with statues of Hungarian Saints
- Calvary
- Lourdes' Cave
- A place of worship dedicated to the unborn children.

Church services: from May to October (and for wedding and baptism ceremonies)

Objective: During the pandemic, there was a significant change in visitor habits that had both positive and negative effects.

Methodology: Monitoring and analyzing changes in visitor habits and needs during the pandemic period. Our guards record the estimated number of visitors per day.

Conclusion:

Negative effects:

- Fewer options for experience-based education. Reason: digital education, social distancing
- Risk of infection - wooden playground disinfection obligation
- Fewer wedding ceremonies
- Church ceremonies were paused.
- Unwanted people has appeared who don't respect the forest, don't follow the rules
- A lot of rubbish "arrived" with the visitors. Our response: "Please take your rubbish with you!"
- Sometimes the arboretum was overcrowded.

Positive effects:

- Significant demand for outdoor events: concerts - classical and meditative music
- Demand for outdoor courses: yoga, nordic walking
- Became a real community park – meeting point for families, communities
- New visitors from nearby parts of the country, too.
- New service: Forest Exit Room has begun
- As a result a chance to make the collection better known to visitors.

• **Keywords:** *eco-attraction, Kecskemét, arboretum, forestry, KEFAG, plant collection, introduction, pandemia, event, outdoor, education*



## AN ACTION TO EXPAND THE GENERAL PUBLIC'S KNOWLEDGE OF THE CITES PLANT SPECIES OF EUROPE

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When it comes to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), the general public in Europe is perhaps aware that some exotic species of animals and plants are overexploited and protected by its regulations. A widespread popular knowledge of plants which are part of the native European flora and included into CITES Appendices is not accomplished in our societies. An attempt to familiarize this knowledge in an attractive, accurate and simple way is conducted as a part of the COST Action CA 18201 "An integrated approach to conservation of threatened plants for the 21<sup>st</sup> century". The goal of this endeavor is to raise awareness about CITES plant species native to Europe and to disseminate information to a broad public about their beauty and importance, as well as highlight the threats they face. Moreover, it shall provide easy, but accurate ways to identify plants protected by CITES for a diversity of stakeholders. So far, a group of 27 scientists representing 5 countries have prepared short descriptions of 47 taxa of all 280 European species protected by CITES. They are illustrated with original photographs, which properly represent each taxon. The didactic value is connected with the fact that the descriptions and pictures are made by botanists, therefore ensuring their correctness. The portrayals are open to public and available at the webpage <https://www.conserveplants.eu/en/cites>, and a part of them is published by the Primorska University in a form of a booklet.

• **Keywords:** *CITES, plants of Europe, booklet*





## THE BOTANICAL GARDEN OF THE ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ - 20 YEARS OF ARTISTIC AND CULTURAL ACTIVITIES

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Botanical Gardens in Poland and around the world combine their various roles connected with nature itself with broadly understood general social activities, carried out in cooperation with external institutions and individuals. The purpose of this presentation is to show the Botanical Garden of the Adam Mickiewicz University in Poznań as a center of artistic and cultural activity in 2001-2021.

The Botanical Garden in Poznań was established in 1925. At present it covers an area of nearly 22 ha. Since 2006, we have a modern Exhibition and Education Centre with a spacious exhibition and lecture hall. So far, over 150 photography, painting and sculpture exhibitions inspired by both nature and culture have been organized there. The exhibitions were accompanied by lectures, workshops, concerts and meetings with authors. The Garden's activities focus also on presenting various cultural circles. We host naturalists, travelers, researchers and artists who explore other countries through their nature and culture and share their knowledge and findings with us. Artistic open-air events, including international ones, as well as photo contests for visitors were also organized in the Botanical Garden. Since 2013, the AMU Botanical Garden has been organizing poetry and music meetings under the name "Literary Bench". Music accompanies also other events taking place in the Garden, like, among others, cyclical activities, such as the May Weekend at the Botanical Garden and the Botanical Garden's Birthday. Every year, cultural events are graced by actors, instrumentalists, vocalists, choir groups as well as many amateur art lovers, like music and dance clubs, vocal groups, school choirs and regional groups.

Artistic and cultural activities play a very important role in our Garden. They attract a wider audience and create an opportunity for the visitors to commune and reconnect with nature.

• **Keywords:** *cultural events, exhibition, poetry*



## FROM THE BOTANICAL GARDEN INTO THE WILD - THE GERMANY-WIDE JOINT-PROJECT FOR WILD PLANT CONSERVATION

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While *ex-situ* conservation and reintroductions have been widely used for threatened vertebrates, these measures have only recently gained increased attention in rare plant conservation. Given the widespread destruction of habitats of wild plants in recent decades, seed banks and cultivation in botanic gardens coupled with reintroduction efforts have become an important tool for the conservation and survival of rare plant species in the wild.

Since 2013, the Germany-wide joint-project "Wildpflanzenschutz-Deutschland" (WIPs-De) has focused on rare species, for which Germany has a particular national responsibility due to their main distribution in Central Europe or a significant proportion of their global distribution range here.

The scope of the project includes storing the seeds of target taxa in the seedbanks to preserve their genetic diversity, as well as the cultivation of these plants in conservation cultures in several botanical gardens. In those endangered species, in which population decrease has been particularly dramatic, long-term reinforcement of populations *in-situ* and supplementation of populations in suitable sites are intended to halt this decline. In addition, social awareness will be increased by public outreach efforts using educational materials, both for botanic gardens and *in-situ* activities.

The project WIPs-De comprises the botanical gardens of the Universities of Osnabrück, Potsdam, Regensburg, the Botanic Garden and Botanical Museum Berlin and the "Grüne Schule" in the Botanic Garden of the Johannes Gutenberg-University Mainz. Each partner is contributing their expertise to a specific task within the network. The botanical gardens implement specific measures in close collaboration with local authorities, nature conservation organisations and regional associations.

WIPs-De is funded by the Federal Agency for Nature Conservation within the framework of the Federal Biological Diversity Program with funds of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety from 2013-2023.

• **Keywords:** *ex situ, in situ seedbanks cultivation of rare plants, reintroduction, education*



## 200 YEARS OF THE HUNGARIAN NATIONAL BOTANIC GARDEN

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*National Botanic Garden Vácrátót, Hungary*

The history of National Botanic Garden - NBG began about two hundred years ago when the Gheczy family obtained a land at Vácrátót in the early 19th century. The actual present landscape garden started to form its shape when Count Sándor Vigyázó, an eager plantsman, purchased the property for his wife, Baroness Zsuzsanna Podmaniczky, as a wedding gift in 1871.

During his time, the garden reached its peak and became one of the country's finest landscape gardens. The count hired a well-known Hungarian landscape designer, Vilmos Jámbor to layout the current form of the garden, and he also employed a vast number of workers to maintain and develop its property. They put enormous effort into the construction, digging ponds, moving a tremendous amount of soil, transporting huge rocks to the property from the nearby hills, and the landscape garden design; numerous romantic garden elements were also installed, such as folly and a watermill.

Count Vigyázó was a true patriot. In 1921, he passed his immense wealth to the Hungarian Academy of Sciences – HAS (actually, which saved the institute's existence as it had significant financial issues at the time). His venerable decision and the grandiose garden development through half a century is the reason we might consider this period as the origin and foundation of the botanic garden.

Following his death, the garden experienced gradual downfall and decay. Loss of maintenance, relatives suing the family for the inheritance, ownership changes; it all took its toll, and the once beautiful garden began to fade. The decline continued with World War II, the Russian army stationing in the garden, and the communists seizing the property in the second half of 1940s years.

It was not until 1952 when the garden started to regain its original shape when the HAS obtained the property, and a Research Institute of Botany was founded in its premises. As a result of the hard work of botanists and gardeners, the garden slowly regained its original form and turned to become a living botanical collection. During last 70 years not only the managed to reconstruct and regain the design and the structure, but also the NBG became the flagship of the botanic gardens in Hungary. Currently, the NBG hosts over 12.000 taxa; it is a Nature Conservation Area and a listed built heritage.

• **Keywords:** -

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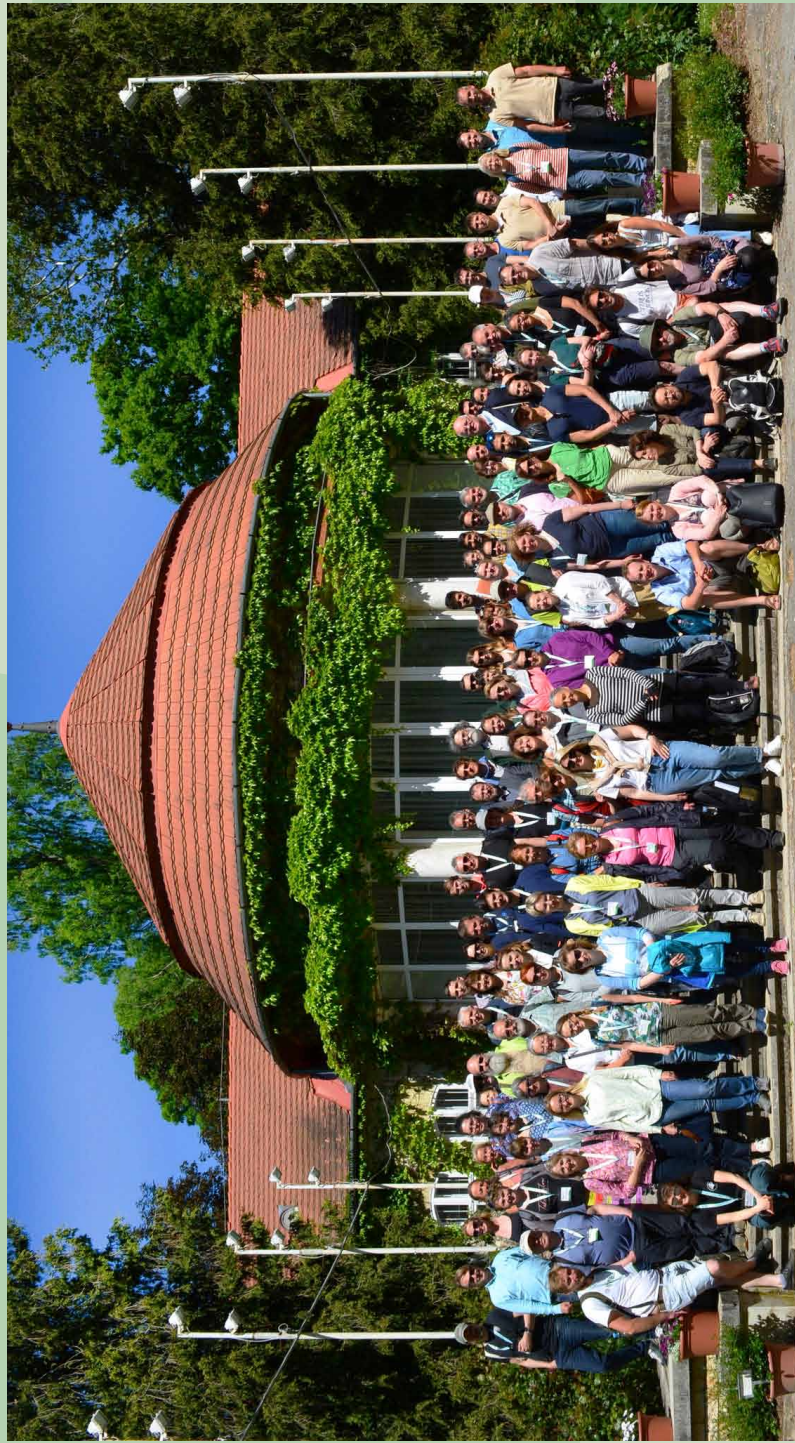
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