Dear Colleagues and Friends,

It is our honour to welcome you to the 3rd Conference of Eastern and Central European Botanic Gardens to be held in Budapest, Hungary from 9 to 11 October 2017 at the Buda Campus and Arboretum of Szent István University on the occasion that the organizer Hungarian Association of Arboreta and Botanic Gardens (HAABG) celebrates its 25th anniversary this year.

We appreciate and reckon EastCentGard as a valuable and important regional initiation, so our committed intention is to revitalize it. EastCentGard III to follow in line ECG I (Tartu, Estonia - 2003) and ECG II (Warsaw/Rogów, Poland - 2007) and it is going to address the classic features of botanic gardens and the challenges they are currently facing in the CEE region.

Focusing on the relations of botanic gardens and society, especially in terms of serving public goods, main topics cover the function of botanic gardens as knowledge centres, the triad of strategy- management-operation as well as social aspects of gardens' classic roles including conservation and education.

We do hope you will enjoy the oral and poster presentations about nice examples, successful projects, model cases, good practices and/or fruitful collaboration with strong BG activity and/or partnership, all of them are worthy for following/adaptation. Over the main themes, several botanic gardens and arboreta and/or their national network will be introduced in the poster section.

Although EastCentGard III is a region-focused conference, it is an open community which welcomes experts from any other part of Europe or other continents.

We are wishing you a fruitful conference in Budapest, Hungary!

On behalf of the Scientific and Organizing Committees,

Géza KÓSA
President of HAABG
Co-chair of Scientific Committee

Vince ZSIGMOND
Secretary General of HAABG
Chair of Organizing Committee

Patron of the Conference

HE Dr. János ÁDER - President of the Republic

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EUROPEAN BOTANIC GARDENS CONSORTIUM

National Botanical Garden Vácrátót

SZENT ISTVÁN UNIVERSITY

General Information

Conference Date

9-11 October, 2017

Conference Venue

Szent István University, Buda Campus (1118 Budapest, Villányi út 29-43.)
Monday Sessions: 'A' Building, Room A1 (entry from Ménesi út/street or Villányi út/street)
Wednesday Sessions: 'K' Building, Room K2 (entry from Villányi út/street)

Official Language

The official language of the conference is English.

Programme Committee

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Co-chair: Géza KÓSA
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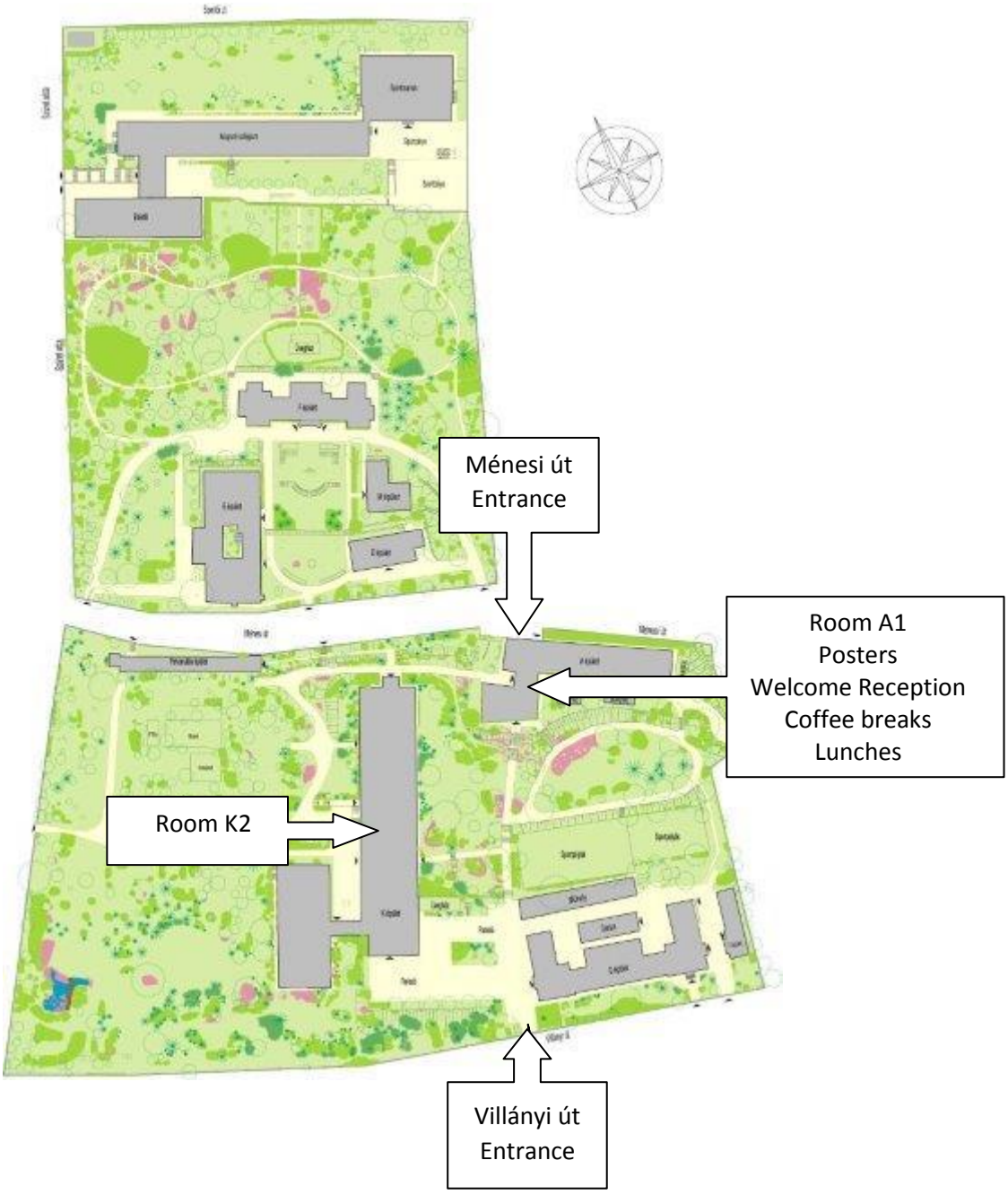
Map of the Buda Campus



Conference Topics

Theme 1: BGs – Knowledge Centres supporting society

- BGs are research infrastructures - living collections on 1st place as well as specialist staff, furthermore buildings and equipment
- BGs provide knowledge for the society on wide scale – botany, ecology, agriculture/horticulture, sustainability, green infrastructure, green/smart city, etc.
- BGs support by their infrastructures and knowledge several fields of economy, agronomy, industry, etc.

Theme 2: Strategy – management – operation

- BGs are living museums need strategic thinking, permanent development, professional management on every activities and daily operation as well
- BGs maintain and exhibit living collections and all the necessary (garden) infrastructure for all of their main linking activities: education, research, nature and built heritage conservation, ecotourism and recreation, cultural events
- BGs have different owners (e.g. state, municipality, private, etc.) and operational institutes (e.g. research, university, etc.) with different emphasises on main activities
- BGs have to optimize not only their own work but have to intend to harmonize it with external environmental, economic, social and other impacts and demands as well
- BGs have to intend to as sustainable operation as possible and display good (own) examples for the public

Round table: Current challenges for BGs

- Saving functions of „classic" BGs in the XXIst Century
- BGs importance as national strategic wealth
- Expectations of the society from BGs
- Rational separation of strange and acceptable demands vs. social pressure
- Suggestions for the solutions of challenges
- New directions for braking out

Theme 3: Education

- BGs provide diverse professional education programmes on nursery, elementary, secondary, high, graduate and post-graduate level as well as support teachers and educators in knowledge transfer about plant kingdom, biodiversity, ecology, sustainability, horticulture, etc.
- BGs ensure attractive environment rich in information and experiences for lifelong self-learning for the public from nursery aged children till elderly people
- BGs sensitize people for nature, make them more respectful for other living beings from small to big, from visible to invisible, etc. and by this to each other, raise people's environmental consciousness
- BGs help to understand operation, behaviour, etc. of living individuals and living systems on higher dimensions, complexity (e.g. community), etc.

Theme 4: Conservation

- BGs are gene banks, biodiversity hotspots growing and saving high quantity of native and non-indigenous plant taxa
- BGs are key institutes of nature conservation mainly by their ex situ conservation and repatriation activities of endangered taxa
- A significant number of BGs themselves are protected area as nature conservation area and/or listed built heritage (e.g. historic garden)
- BGs have important role as scientific workshops in several research and results on positive (natural) and negative (e.g. invasion) processes

Conference Excursion & Dinner

Excursion to National Botanical Garden Vácrátót & Conference Dinner

08:00-21:30, Tuesday, 10 October, 2017
(Included in registration fee of participants and accompanying persons)

Meeting point: Szent István University, Buda Campus Main entrance
(1118 Budapest, Villányi út 29-43.)

Program of the day:

08.00	Departure by bus from conference venue
09.00	Arrival to Vácrátót, welcome coffee
09.00-09.30	Greetings by the hosts,
9.30-11.15	Site visit in 3 groups
11.15-11.45	Coffee break
11.45-13.45	Round Table Disscussion
13.45-14.00	Bus transfer to Vác Port, box lunch
14.00-15.45	Danube Bend river cruise, arrival to Szentendre
15.45-16.15	Walk in Szentendre art village
16.15-16.30	Bus transfer to Open Air Museum of Ethnography, Szentendre
16.30-20.00	Welcome Guided tour Folk dance program Wine tasting Dinner
20.30	Bus transfer back to Budapest
21.30	Drop-off at the conference venue

National Botanical Garden Vácrátót

The 180-year-old romantic landscape-designed garden, also a national monument and nature conservation area, is the richest scientific plant collection of Hungary . The scenes of this 27 hectare park are engaging in all four seasons. Annual plant exhibitions, intimate trails, rose and geranium collections, and countless tiny wonders of nature await our guests throughout the year.

Danube Bend cruise

The Danube bend is the richest destination in art and history in Hungary. Cruise along the old royal town, enjoy a superb view of the Danube bend, the ruins of forts and castle, heading to the artists' town.

Szentendre

The picturesque town of Szentendre sits at the foot of the Pilis Hill, where you'll experience a Mediterranean atmosphere that few other Hungarian settlements can offer you. No wonder that lots of artists come to find inspiration and work here. Let this unique aura enchant you too.

Open Air Museum of Ethnography

The collection of the vernacular architecture and interior furnishings, objects and spiritual relics contributes to the conservation of the cultural heritage of rural Hungary.

Acknowledgement to our Sponsors and Exhibitors

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Conference Programme

Monday, 9 October 2017

09.00-09.30 **Conference Opening Ceremony**
Géza KÓSA
President of Hungarian Association of Arboreta and Botanic Gardens
Liliána ZÚGÓ
Representative of The European Commission Representation in Hungary
Dr. Attila HEGEDŰS
Dean of the Faculty of Horticultural Science, Szent István University

09.30-11.00 **Opening Plenary**
Chair: Heiki TAMM

09.30-10.00 **The Botanical Gardens in the Central and Eastern Europe. The Current State of Affairs and the New Challenges and Prospects for Collaboration**
Jerzy PUCHALSKI[1], Paweł KOJS[1,2]
[1]*Polish Academy of Sciences Botanical Garden – Center for Biological Diversity Conservation, Warsaw, Poland*
[2]*Silesian Botanical Garden, Mikołów, Poland*

10.00-10.30 **Building a global system for the conservation of all rare and threatened plant species. What can botanic gardens do to prevent plant species extinctions?**
Paul SMITH
Botanic Gardens Conservation International

10.30-11.00 **The Dendrological Trail at the Budakeszi Herbarium: Re-created native habitats from around the world demonstrate plants' genetic memory for cold hardiness**
Zsolt DEBRECZY
International Dendrological Foundation

11.00-11.30 Coffee break / Poster viewing

11.30-12.50 **Section I.: Strategy – management – operation I/1.**
Chair: under conciliation

11.30-11.50 **Development of botanic gardens of Estonia in the period between the EastCentGard 1 – 3 (2003-2016)**
Heiki TAMM[1], Jüri SILD[1], Siiri LIIV[2]
[1]*Museum of Nature History and Botanical Garden of the University of Tartu, Tartu, Estonia*
[2]*Tallinn Botanic Garden, Tallinn, Estonia*

11.50-12.10 **Croatian Botanical Gardens and Arboreta within the UNESCO's International Year of Sustainable Tourism for Development (2017)**
Sanja KOVAČIĆ
University of Zagreb, Faculty of Science, Department of Biology, Botanical Garden, Zagreb, Croatia

12.10-12.30 **Botanic Gardens – promotors of ecotourism**
Jože BAVCON, Blanka RAVNJAK
University Botanic Gardens Ljubljana, Department of Biology, Biotechnical Faculty, Ljubljana, Slovenia

12.30-12.50 **The Folly Arboretum and Winery**
Réka FOLLY
Folly Arboretum and Vinery, Badacsonyörs, Hungary

12.50-13.50 Lunch break / Poster viewing

13.50-14.50 **Section I.: Strategy – management – operation I/2.**
Chair: under conciliation

13.50-14.10 **BGCI's databases, tools to support plant conservation prioritisation and practice**
Suzanne SHARROCK
Botanic Gardens Conservation International

14.10-14.30 **Current management directions in the O.V. Fomin Botanical Garden**
Vitaliy KOLOMIYCHUK, Oleksandr SENCHYLO
Taras Shevchenko National University of Kyiv, O.V. Fomin Botanical Garden Kyiv, Ukraine

14.30-14.50 **The impact of the implemented developments for the protected values, building of the society connections and education in Arboretum of Szarvas**
Katalin HANYECZ, Márta SOMLYAI, Sándor TÓTH
Szent István University, Arboretum of Szarvas, Szarvas, Hungary

14.50-15.20 Coffee break / Poster viewing

15.20-17.20 Section II.: Education
Chair: Mária HÖHN

15.20-15.40 **Targeting different audiences: education in Warsaw University Botanic Garden**
Marcin ZYCH, Iwa KOŁODZIEJSKA, Krystyna JĘDRZEJEWSKA-SZMEK, Hanna WERBLAN-JAKUBIEC
University of Warsaw, Faculty of Biology, Botanic Garden, Warsaw, Poland

15.40-16.00 **Let's visit the Botanical Garden in Vácrátót! - The educational system of the National Botanical Garden**
Erzsébet FRÁTER, Gergely LUNK, Géza KÓSA, Barbara SÓLYOM
HAS Institute of Ecology and Botany – Centre for Ecological Research, National Botanical Garden, Vácrátót, Hungary

16.00-16.20 **Why botanical gardens matter for neuroeducation?**
Maciej BŁASZAK[1], Justyna WILAND-SZYMAŃSKA[2]
[1]Adam Mickiewicz University, Faculty of Social Sciences, Poznań, Poland
[2]Adam Mickiewicz University, Botanical Garden & Faculty of Biology, Poznań, Poland

16.20-16.40 **The flora of walls in University Botanic Garden – Balchik (Bulgaria)**
Krasimir KOSEV[1], Anely NEDELCHEVA[2], Anita TOSHEVA[2], Ivan SVINYAROV[3], Venelina ANGELKOVA[3]
[1]Sofia University 'St. Kliment Ohridski', University Botanic Gardens, Sofia, Bulgaria
[2]Sofia University 'St. Kliment Ohridski', Faculty of Biology, Sofia, Bulgaria
[3]Sofia University 'St. Kliment Ohridski', Faculty of Chemistry and Pharmacy, Sofia, Bulgaria

16.40-17.00 **Roof garden – Biology classroom**
Blanka RAVNJAK[1], Jože BAVCON[1], Veronika BABIČ[2]
[1]University Botanic Gardens Ljubljana, Department of Biology, Biotechnical Faculty, Ljubljana, Slovenia
[2]Gimnazija Ledina, Ljubljana, Slovenia

17.00-17.20 **The role of the Buda Arboretum in Landscape Architecture education in Hungary**
László Zoltán NÁDASY[1], Judit DOMA-TARCSÁNYI[2], Krisztina SZABÓ[2]
[1]Szent István University, Faculty of Landscape Architecture and Urbanism, Department of Landscape Protection and Reclamation, Budapest, Hungary
[2]Szent István University, Faculty of Landscape Architecture and Urbanism, Department of Garden and Open Space Design, Budapest, Hungary

17.30-18.30 Guided Tour in Buda Arboretum

18.30- Welcome reception

Tuesday, 10 October 2017 – Field Trip, Excursion day

11.45-13.45 Round table discussion

Moderator: Michael KIEHN, Scientific Director of BG of University of Wien

Participants: Pawel KOJS President of Polish Network of Botanic Gardens
Géza KÓSA President of Hungarian Association of Arboreta and BGs
Miklós PERSÁNYI Director General of Budapest Zoo & Botanic Garden
Krasimir KOSEV Director of University Botanic Gardens, Sofia

Themes: Saving functions of „classic" BGs in the 21st Century
BGs importance as national strategic wealth
Expectations of the society from BGs
Rational separation of strange and acceptable demands vs. social pressure
New solutions, directions and trends for braking out

Wednesday, 11 October 2017

08.00-09.40 Section III.: Strategy – management - operation II.
Chair: Justyna WILAND-SZYMANSKA

08.00-08.20 **The International Plant Exchange Network (IPEN): a Botanic Gardens´ approach to cope with the Nagoya Protocol of the Convention on Biodiversity**
Michael KIEHN, Frank SCHUMACHER
Core Facility Botanical Garden, University of Vienna, Vienna, Austria

08.20-08.40 **"Hippocrates Botanical Gardens" Network**
Irini VALLIANATOU, Anagnosti John CHOUKALAS, Athanasios KOUTSIANAS
Hippocrates 2500 years, Athens, Greece

08.40-09.00 **Information handling related to plant materials in Botanic Gardens**
Antal RADVÁNSZKY[1,2]
[1]FITOKIT Consulting and Service Ltd., Zsombó, Hungary
[2]Hungarian Association of Arboreta and Botanic Gardens (HAABG), Budapest, Hungary

09.00-09.20 **Vilnius Botanical garden: To improve the quality of plant collections**
Edita BUTKEVIČIŪTĖ, Vytautas KUZMA, Audrius SKRIDAILA
Vilnius University Botanical Garden, Vilnius, Lithuania

09.20-09.40 **Larix genus in Botanic garden of Klaipėda University – West Lithuania**
Asta KLIMIENĖ, Laura NORMANTĖ
Klaipėda University Botanical Garden, Klaipėda, Lithuania

09.40-10.10 Coffee break / Poster viewing

10.10-12.50 Section IV. - Conservation
Chair: Dr. Erika PÉNZESNÉ KÓNYA

10.10-10.30 **Conservation of plants by translocation: some examples from the practice of botanical gardens**
Lyudmila KAVELENOVA[1], Svetlana ROZNO[2], Alexander POMOGAYBIN[2], Irina RUZAYEVA[2]
[1]Samara National Research University, Department of Ecology, Botany and Nature Protection, Samara, Russia
[2]Samara National Research University, Botanical Garden, Samara, Russia

10.30-10.50 **The European Native Seed Conservation Network (ENSCONET) Consortium**
Michael KIEHN[1], Elinor BREMAN[2], Angelino CARTA[3], Mari MIRANTO[4]
[1]Core Facility Botanical Garden, University of Vienna, Vienna, Austria
[2]Millennium Seed Bank, Royal Botanic Gardens Kew, Wakehurst, United Kingdom
[3]Università di Pisa Dipartimento di Biologia, Pisa, Italy
[4]Seed Bank, Finnish Museum of Natural History LUOMUS, Botany Unit, Helsinki, Finland

10.50-11.10 **Ex situ conservation in the Botanical Garden of Eötvös University**
László PAPP, László ORLÓCI
Botanical Garden of Eötvös Loránd University, Budapest, Hungary

11.10-11.30 **Protection vs. Development? Sustainable Development of the 1021 Years Old Benedictine Monastery of Pannonhalma**
Ákos POTTYONDY
Pannonhalma Monastery, Pannonhalma, Hungary

11.30-11.50 **Activity of Kaunas Botanical Garden of VMU on the protection of endangered and rare plants of boreal forests**
Laima ČESONIENĖ[1], Remigijus DAUBARAS[1], Sigitas JUZĖNAS[2], Marcin ZYCH[3]
[1]Kaunas Botanical Garden of Vytautas Magnus University, Kaunas, Lithuania
[2]Vilnius University Life Science Centre, Vilnius, Lithuania
[3]University of Warsaw, Faculty of Biology, Botanic Garden, Warsaw, Poland

11.50-12.10 **Long-term monitoring in the Soroksár Botanical Garden tracking resilience and change of natural Pannonian habitats**
Mária HÖHN, Gábor BOTTLIK, György BEYER
Szent István University, Faculty of Horticultural Science, Department of Botany and Botanical Garden of Soroksár, Budapest, Hungary

12.10-12.30 **The conservation of the Romanian flora in one botanical garden - the first project of this kind in the country**
Paul-Marian SZATMARI, Marin CĂPRAR, Cristina-Mirela COPACI, Lia MLADIN, Cosmin SICORA
Biological Research Center Jibou, Sălaj County, Romania

12.30-12.50 **Living collections of tropical orchids in Ukraine: research, educational and conservational missions**
Lyudmyla BUYUN, Lyudmyla KOVALSKA, Roman IVANNIKOV, Volodymyr VAKHRUSHKIN
M.M. Gryshko National Botanical Garden of National Academy of Sciences of Ukraine, Kyiv, Ukraine

12.50-13.50 Conference closing

13.50-15.00 Lunch break / Poster viewing

The Organisers cannot assume liability for any changes in the scientific program due to unforeseen circumstances. Organisers will do their best to keep the participants up to date, possible changes in the program will be immediately communicated.

Poster Session

Posters will be exhibited in the social area/foyer of the conference venue on Monday and Wednesday.

Abstracts

Opening Plenary Session

The botanical gardens in Central and Eastern Europe. The current state of affairs and the new challenges and prospects for collaboration

Jerzy PUCHALSKI[1], Paweł KOJS[1,2]
[1]*Polish Academy of Sciences Botanical Garden – Center for Biological Diversity Conservation, Warsaw, Poland*
[2]*Silesian Botanical Garden, Mikołów, Poland*

It is possible to rank 22 countries among the area of Central and Eastern Europe. Among them are the countries being before 1990 the members of the Eastern Bloc of socialist countries, former republics of the Soviet Union and the republics of the former Yugoslavia, as well as, Albania. According to the BGCI's GardenSearch database 217 botanical gardens are located in this area of Europe. Among them 137 in classic meaning are botanical gardens with various plant collections, 50 arboretums or dendrological gardens holding mainly collections of woody plants and 31 gardens of other types: palm houses, gardens of medicinal plants or gardens of native flora. For the current state of affairs of botanical gardens located in Central and Eastern Europe very important is their managing body which is financing their activity. Until 1990 it was common to organize big botanical gardens or arboretums as the research units of the national academics of sciences, supported from the governmental funds. At present this type of botanical gardens remained only in a few countries. In total there are 15 botanical gardens as research units of the national academics of sciences or acting in the framework of the structure of academies research institutes. But the majority of botanical gardens, as much as 80, are the units of universities. 25 botanical gardens are municipal or regional institutions funded by city or region authorities. Also 20 arboretums or dendrological gardens belong to state forests or national parks. Only 4 botanical gardens are private. At present 11 countries from this region of Europe are members of the European Union, with total number of 149 botanical gardens. For the development of their activity very important was their membership in the European Botanic Gardens Consortium (since 2004) and the participation in various EU projects and programs, for example ENSCONET, ERASMUS or INTERREG.
Keywords: botanical garden, Europe, EU projects, academy of sciences

Building a global system for the conservation of all rare and threatened plant species. What can botanic gardens do to prevent plant species extinctions?

Paul SMITH
Botanic Gardens Conservation International

Botanic gardens offer the opportunity to conserve and manage a wide range of plant diversity *ex situ*, and *in situ* in the broader landscape. The rationale that botanic gardens have a major role to play in preventing plant species extinctions through integrated plant conservation action is based on the following assumptions:

- There is no technical reason why any plant species should become extinct. Given the array of *ex situ* and *in situ* conservation techniques employed by the botanic garden community (seed banking, cultivation, tissue culture, assisted migration, species recovery, ecological restoration etc.) we should be able to avoid species extinctions.
- As a professional community, botanic gardens possess a unique set of skills that encompass finding, identifying, collecting, conserving and growing plant diversity across the entire taxonomic spectrum

Botanic Gardens Conservation International (BGCI) is a membership organization representing a network of 500 botanic gardens in 100 countries, and around 60,000 scientists, horticulturists and educators - the largest plant conservation network in the world. This network already conserves and manages more than 90% of plant families, 50% of genera and 30% of species in its living collections and seed banks. Following the example of the crop conservation community, BGCI's botanic garden-centered Global System for the conservation and management of plant diversity aims to collect, characterize and conserve all of the world's rare and threatened plants as an insurance policy against their extinction in the wild and as a source of plant material for human innovation, adaptation and resilience.
Using tree conservation as an example, the speaker will set out the approach, methodologies and milestones being employed by botanic Gardens and arboreta to ensure that no rare and threatened species becomes extinct.

The Dendrological Trail at the Budakeszi Herbarium: Re-created native habitats from around the world demonstrate plants' genetic memory for cold hardiness

Zsolt DEBRECZY
International Dendrological Foundation, Inc.

The Budakeszi Herbarium*, the Hungarian laboratory of the International Dendrological Research Institute Inc. of Massachusetts, USA, is a repository for a quarter of a million-specimen herbarium and is surrounded by 2 hectares of inter-connected living collections along its Dendrological Trail and in their taxonomical plantations.
The living plant collection along the Trail was created with the herbarium's supporting material in mind so that it is authentic and references well-recorded taxa. Both the Trail and herbarium are appropriate for education, serve as an ex situ gene reserve, are a resource for international plant-material exchange, and can even be used for conservation purposes. In addition, the collection is testament to our** studies of plants' genetic memory – cryptic properties – related to morphology and cold hardiness. We have special interest in the contradiction of the morphology of plants masked by their survival strategies in native habitats' harsh circumstances vs. the same (well documented) taxa in ideal to supreme conditions in arboreta. Leaf size, shape, and margins and even "more conservative" parts such as inflorescences are all subject to change in dramatically different conditions. Also in open air selection of seedlings grown in our experimental seedbeds has demonstrated that many supposedly tender taxa are perfectly hardy in our USDA zone 7 climate. Such a large scale of hidden cold hardiness can only be explained by the vegetation history of these studied taxa, that is, by the supposition that they formerly thrived in much colder areas than they inhabit today.
The Dendrological Trail and the plantations around and nearby the Budakeszi Herbarium have close to 1800 woody taxa, and the trail alone presents 650 wild-collected trees and shrubs introduced from their native habitats and planted in geographical synecology-type groupings. The European and Californian mediterranean sections are based on woody taxa which are, in general considered "not hardy" in our Central European climate. Mexican conifers, rare evergreen trees and shrubs complement the regional collections along the Trail and serve both experiments and educational purposes.

*International Dendrological Foundation
**Dendrological Atlas Project team

Keywords: Budakeszi Herbarium, dendroflora, hardiness, conservation, education

Section I.: Strategy – management – operation

Development of botanic gardens of Estonia in the period between the EastCentGard 1 – 3 (2003-2016)

Heiki TAMM[1], Jüri SILD[1], Siiri LIIV[2]
[1]*Museum of Nature History and Botanical Garden of the University of Tartu, Tartu, Estonia*
[2]*Tallinn Botanic Garden, Tallinn, Estonia*

The number of accessions of the Tallinn Botanic Garden (TBG) in 2003 8 088, and in 2016 – 8 780; in the Botanical Garden of the University of Tartu (BGUT) accordingly 6 500 and 10 000. Environmental education was carried out intensively by means of exhibitions, thematic days, and guided tours. In 2006, TBG launched programs for children to match the school curriculum. The number of visitors in TBG increased from 37 383 in 2003 to 56 039 in 2016; in BGUT the increase was from 5 000 to 17 500. TBG takes part in two reserch programs in biodiversity conservation and in environmental studies. For storing the data about the plant collections, TBG uses an Excel based database, and BGUT uses ArcGis. There are also special databases about the herbarium in TBG (80 000 records) and about rare and valuable ornamental plants in BGUT (550 records). Conservation programs are going on according to GSPC Targets VII, VIII, and IX. The budget of TBG was in 2003 593 000 EUR, in 2016 – 1 108 300 EUR, and the BGUT one was 112 900 EUR and 400 000 EUR respectively. The total number of employees in TBG in 2003 was 51, and it has not changed. BGUT raised the number of employees from 11 to 16.
All greenhouses of both botanic gardens have been renovated. In 2007, a new experimental and reproduction garden (0,5 ha) was opened in BGUT. Many new displays were opened in both gardens, such as the permanent exhibition of lichens, mosses and fungi, the garden of senses in TBG, and the gardens of peonies, of Clematis, of medicinal plants, of mosses in BGUT. The territory of TBG diminished from 123 ha in 2003 to 46 ha in 2016; of BGUT – from 7,5 ha to 4 ha. Both botanic gardens started to use more environmentally friendly fuels in their heating centres. The Estonian botanic gardens are members of the Botanic Gardens Conservation International, the EU Botanic Gardens Consortium, and the Association of the Baltic Botanic Gardens.
Keywords: botanic gardens, Estonia

Croatian botanical gardens and arboreta within the UNESCO's *International Year of Sustainable Tourism for Development* (2017)

Sanja KOVAČIĆ
University of Zagreb, Faculty of Science, Department of Biology, Botanical Garden, Zagreb, Croatia

Increasingly attractive tourist destination, Croatia is famous for its warm Adriatic Sea, with beautiful coastline and many islands. However, besides its famous natural, historic and cultural merits, Croatia has lots of potential in the various combinations of these, with botanic gardens and arboreta being just one part of it and in accordance to the UNESCO's International Year of Sustainable Tourism (2017).
In Croatia 8 botanic gardens and 3 arboreta are officially registered, managed by various institutions, such as Faculties, Public Institutions, Museums and Schools. Most of them are statutorily protected as Monuments of park architecture or/and Monuments of culture. There are 4 University botanic gardens (in Zagreb, Split and Dubrovnik) and 2 mountain botanic gardens (the Velebit Mt and the Biokovo Mt) managed by the County Public Institutions; with 1 Museum (Rijeka) and 1 School (Kaštela) botanic garden recognized as nationally important. Three arboreta – Trsteno, Opeka and Lisičine – managed by the Croatian Academy of Arts & Sciences, Public Institution and Forestry Department, respectively, are also subjected to diverse laws of protection at the state level.
National botanic gardens and arboreta, together with many other botanical collections in the country, are joined within the Croatian Botanical Society as members of the Section of botanic and school gardens, arboreta and botanical collections. For the first time this season (2017), Croatian botanical gardens step forward to propose joint touristic offers for the foreign market, within the "Croatian Nature & Heritage Tours" programme.
What is that Croatian botanic gardens and arboreta have to offer, and what perspective does this potentially sustainable type of touristic offer have in the future, it is yet to be seen.
Keywords: Croatia, botanical gardens, sustainable tourism.

Botanic gardens – promotors of ecotourism

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The Botanic Garden of the University of Ljubljana has a long tradition of collaboration with Central European botanists. Foreign botanists frequently visited Slovenia, joining locals on joint excursions, sometimes for longer periods. Valvasor, who published his famous Iconotheca of Carniolan flora in the 17th century, already noted that he had published this work to present this flora and fauna to the wider surroundings of Europe. Foreign botanists came to Ljubljana to study botany even before the Botanic Garden was established. Following 1810,

when the Botanic Garden was founded, such visits have only increased. Throughout the history of the Garden, all heads of the garden, as well as its gardeners, have quite fruitfully collaborated with all middle-European botanists, horticulturists, as well as plant enthusiasts of the time.
More recently, in the last 20 years, the Garden has been active in pursuing various forms of ecotourism. To begin with, we initiated nature tours in Slovenia for visiting specialists. We also offered our knowledge to local domestic groups on excursions into different European countries, with topics concerning plants and gardens. In the last decade, we increasingly focused on the native flora, which we present to different interest groups from various parts of Europe. To this end, we organised thematic festivals of common snowdrops, where we attempted to attract as many visitors as possible with our own lectures and presentations by foreign experts, and presented the Slovenian flora during the snowdrop blooming season. Students have also expressed great interest in the Garden, visiting it through various Erasmus exchanges and internships in the last seven years. During this time, we have organised two summer schools for foreign students, where they explored plants, and learned about their habitats and ecology. We also organised guided excursions on the Slovenian flora for our colleagues at other botanic gardens. We led excursions for renowned horticultural groups and societies from England. This year, for the World Rose Society, we led numerous enthusiasts and experts from throughout the world at the regional convention in Ljubljana. An additional purpose of our activities is to present the very diverse flora of Slovenia to the general public. Since our country lies at the intersection of four phytogeographic regions – sub-Pannonic, sub-Mediterranean, Alpine, and Dinaric – Slovenia has a rich diversity of plant world. According to our experience with different foreign groups, the comments have been very positive. Guided tours also prevent illegal picking of plants. Visitors discover the local flora and its peculiarities, while we provide comparisons to flora of other countries. They, in turn, help to distribute the knowledge of plants throughout the wider region, which is a tradition in our country.
Keywords: botany excursions, summer school, ecotourism

The Folly Arboretum and Winery
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Our botanical garden is not simply an arboretum of many. It's not only a unique collection of cedars and cypresses, but a family history of four generations, a result of dedicated work and perseverance with the help of God. This story begins hundred and twelve years ago in 1905 with Gyula Folly MD, who planted the first conifers to the stoniest and steepest part of the Kisörs Hill, which is in Western Hungary, on the North shore of the Lake Balaton. The whole estate is ten hectares, half of it is vineyards, the other half is the botanical garden. We have cedars, junipers, and an outstanding collection of cypresses that is about three hundred and fifty species of pines altogether.
Uniquelly, the garden is still privately owned by the Folly family as opposed to stately owned gardens in other ex-communist countries. Seven years ago, when I took over the garden from my father, we decided to build up a serious brand as we would like to impress our visitors not only by the actual garden but we would like to send a message through our quality products beyond the arboretum.
After working hard for years, we can proudly say that the phylosophy of our business strategy works. The number of our visitors has dramatically grown, therefore, the sales of our products also multiplied. We have managed to bring our business up onto a different level with creating so much more income which we can reinvest into the development of the Folly Arboretum.
Keywords: Arboretum, Winery, Pines

BGCI's databases, tools to support plant conservation prioritisation and practice
Suzanne SHARROCK
Botanic Gardens Conservation International

Botanic Gardens Conservation International (BGCI) has developed a suite of databases to support conservation planning and practice by botanic gardens and the wider conservation community. The GardenSearch database is the only global source of information on the world's botanical institutions. In addition to over 2,700 botanic gardens and arboreta, GardenSearch also includes gene and seed banks, network organizations, and zoos. The databse can be searched by country, institution or by a wide range of other fields related to facilties and expertise. PlantSearch is a database of the plant collections (both living and seed) maintained by botanic gardens around the world. Linked to a range of other databses, PlantSearch allows threatened species in ex situ collections to be identified. To further support the prioritisation of conservation action, BGCI recently launched a new database – ThreatSearch. This is the most comprehensive database of conservation assessments of plants listing global, regional and national red list assessments. It includes conservation assessments from a variety of sources. Finally, and as a resource to support the Global Tree Assessment (an intiative to red list all the world's tree species by 2020), BGCI has developed GlobalTreeSearch, the most comprehensive list of tree species and their country-level distributions. All four of BGCI's databases are freely available for public consultation on the BGCI website, with enhanced search facilities provided to BGCI's

members through a members' only area of the website. This presentation will introduce the databases and provide examples of how they can be used to support plant conservation in botanic gardens.
Keywords: databases, plant conservation, prioritisation, botanic gardens, ex situ

Current management directions in the O.V. Fomin Botanical Garden
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The Management plan for the Botanical Garden was first developed in 2016. Work on the project consisted of two stages: inventory and planning. Its materials include the analytical part and the management block. In the latter, the justification and proposals for further garden management are given: Development of measures for the protection of nature complexes and objects; Restoration of disturbed territories; Organization of environmental education, scientific and training work; Environmental and economic measures; A list of necessary managerial decisions, scientific, design, survey work, justification of financing from the state and local budgets; Monetary assessment of the main activities of the project.
Priorities of the management for the next 10 years include: Creation of new collections (now the creation of groups of introductory populations is being implemented); Construction of new heating facility; Struggle with erosion processes. Strategic management priorities include: development and preservation of a garden plant collection; Reconstruction of existing plantations and greenhouse buildings; Improvement of the staff schedule; Development of ecological-educational and recreational infrastructure of the garden.
The management objectives in dendrology include: publication of a special catalogue of garden collections until 2019; Continuation of coniferous and evergreen deciduous introduction; Design of seasonal floral areas using a new assortment of plants; Regular sanitary care for plants; Replacement of old trees and shrubs.
Thus, in the O.V. Fomin Botanical Garden for more than 175 years of history plant collections of temperate, tropical and subtropical zones of the planet of over 9,000 species and intraspecific taxa have been created. The project will allow implementing operational measures of management and planning of longer-term strategic measures, which besides the main tasks of the garden will contribute to the greening of the Kyiv urban agglomeration.
Keywords: botanical garden, management, plant collections development

Current developments at the Arboretum of Szarvas: matters of protected values, public relations and fostering education
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Founded by the Bolza family in the early 1800s the Arboretum of Szarvas, state owned since 1943 and currently managed by the Szent István University, is the largest arboretum in Hungary and is a wonderful example of our landscape gardens. Nearly 1,600 species and varieties are cultivated on its 82 hectares of woodland. It is a popular tourist spot which also supports research and education activities. The Arboretum, often called „Pepikert", is a gene bank and part of it is a National Conifer Cultivar collection. The gene bank collection has 231 taxa (133 angiosperms and 98 gymnosperms), while there are 77 taxa in the conifer cultivar collection.
In recent years, EU funds and our own work have resulted in good developments in several fields of the arboretum's life. A habitat development program based on garden history research was completed. Within the framework of this program certain plant groups were renewed, the original spatial structures have been restored, and many new ornamental plants were planted to expand the dendrological collection and increase the plant diversity of the garden.
In addition to the restoration of the arboretum's vegetation, great emphasis was put on the renovation of the artificial structures – buildings and other facilities that serve maintenance work, visitors and education. In addition to university education the Arboretum has also been doing „background education" for the next generation of experts and other workforce. The adult education is carried out in close cooperation with the social organizations of the region.
To foster our public relations, several types of teaching materials, information pamflets and worksheets have been prepared, distributed, and tested in recent years. Shown by the growing number of visitors, the positive social respond, and the arboretum's increasing role played in education it is good to see the arboretum's upward path.
Keywords: protected values, developments, society connections, education

Section II.: Education

Targeting different audiences: education in Warsaw University Botanic Garden

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Our garden is an old university institution in 2018 celebrating its 200th anniversary, and firmly established in the city structures. Nevertheless we felt the need to know more about our audiences. That is why three years ago a sociological research was conducted, to verify who and why comes to our Garden. Audiences which were reached at that time where mostly elderly people, families and school children. The results also showed that many visitors are attracted by the beauty of the site rather than by the scientific and educational values. In 2015 and 2017 for the first time we conducted pilot anthropological research on the Night of the Museums (annual festival of the museums), during which we observed the behaviour and reaction of the visitors to the event. That allowed us to broaden our knowledge about the audiences and their needs. Co-creating with the new audiences raises new challenges and opportunities. For example, collaboration with NGOs gives new communication pathways and a linkage to professionals with different background, but may also cause difficulties. Crossing the garden's borders by going out with educational actions to the communities allows reaching people who never visit the garden. During the talk we will present some examples of events that where co-created with different community groups, migrants, artists and pupils; we will also invite to participate in BGCI's 10th International Congress on Education in Botanic Gardens to be held 9-14 September 2018 in Warsaw.

Keywords: audience, informal education, social network, university

Let's visit the Botanical Garden in Vácrátót! - The educational system of the National Botanical Garden

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The National Botanical Garden is the taxon-richest living plant collection of Hungary, situated only 30 from Budapest. It is also among the country's most popular botanical attractions with more than 40.000 visitors a year.

Our botanical garden has to be well prepared for such level of interest and, when preparing guiding and information materials, be prepared for even the most unexpected questions that might be raised by visitors, schoolchildren and retired people from various age groups, with different educational levels and range of interest. Some people come only for a pleasant walk in the fresh air, away from the city. Other visitors want to learn about plants and animals, and perhaps are keen gardeners or plant enthusiasts. Last but not least there are those, who would really like to know more about how plants function, learn about botany or the science of ecology.

To meet the above described demands is not easy at all, especially that these are additional to our basic scientific, collection-managing and overall development tasks, which remain the same as usual.

The versatile educational information system that we provide for the public has several elements, such as guide booklets, plant of the month leaflets, information boards for permanent and current attractions, didactic trails (with guide booklets), permanent exhibitions on changes of the environment and on the environmental challenges of the 21st century.

Keywords: botanical garden, education, information materials, didactic trails, exhibitions

Why botanical gardens matter for neuroeducation?

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A new approach to educational neuroscience is developed on the basis of the Bayesian framework for cognition. According to it, cognition is powered by hypothesis-testing brain, constantly minimizing its prediction error. Expectations the brain generates are at three distinct levels of computations: (1) sensations are guesses about what the brain is going to receive from the physical world, (2) perceptions are guesses about the cognitive niche, and (3) conceptions are guesses about the axiological mind. If prediction error is small (i.e. the place is perfectly matched with brain's expectations), the surrounding can be treated as a part of the extended human mind.

The botanical garden can be part of the extended human mind, enhancing its cognitive abilities. Firstly, it reduces the stress level. Secondly, it can promote efficient action. Thirdly, it can stimulate creative reflection. All three functions supported by three distinctive cortical networks can find application in both science and humanistic education. The need for leisure time in educational process, during which the most important

mental processes take part, is crucial for a human mind. Botanical gardens are perfect places for implementing education based on sustainable development of all human cognitive, emotional and motivational needs.
Keywords: neuroeducation, cognition, Bayesian framework

The flora of walls in University Botanic Garden – Balchik (Bulgaria)
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Restored and constantly cleaned walls present a unique opportunity for spontaneous colonization by the plants of the diversified surrounding landscape. The aim of this study is to establish species diversity, characteristics and trends about the origin and variability of the vascular mural flora („green walls") in the nine sites of University Botanic Garden – Balchik.
During the study we determined more than 80 species and 65 genera and found the most common families are Asteraceae (8%), Caryophyllaceae (8%) Poaceae (7%), Fabaceae (4 %), Rosaceae (4 %), Moraceae (4 %) and Amaranthaceae (4 %).
Some of the species used for „greening the walls" are accepted as an additional ornamental elements and contribute to the complete perception of architectural and historical sites, especially *Cymbalaria muralis*, *Hedera helix, Ficus carica* and *Polycarpon tetraphyllum*. The total representation of alien species on the studied walls is 17% and a few of them are also highly invasive (*Ailanthus altissima*, *Acer negundo*, *Amaranthus hybridus*, *Euphorbia maculata, Oxalis corniculata* and *Oxalis dilenii)*. The dominant floristic elements are Adv (25%), Kos (16%), Eur-As (16%) and subMed (10%) and the wall flora shows characteristics similar to the Mediterranean wall floras.
The wall flora plants in almost all of the studied sites create an additional decorative effect on the walls and the buildings as archeological and historical sites and contribute to their general aesthetic perception. The growth of trees causes a strong and negative effect on their consistence. It is necessary to observe constantly the degree of vegetation on the walls and their surrounding area and not to let it spread excessively.
Keywords: urban flora, vascular plants, wall flora, wall preservation

Roof garden – Biology classroom
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The overall work of botanic gardens does not encompass only care for the plant collections, keeping up seed banks, and protection of plant species, but also includes, to a great extent, education. Normally, education activities are conducted directly within the botanic gardens, in the form of educational tours, workshops, exhibitions, and similar activities. However, it is increasingly important that gardens distribute their knowledge beyond their boundaries and reach the attention of the general public. The Botanic Garden of the University of Ljubljana is already successfully collaborating with various institutions and promoting the rich flora of Slovenia. In 2014, we started the planting project for the roof garden, parking lot, and a green area adjacent to the school (Gimnazija Ledina) in Ljubljana. The roof garden includes three longitudinal concrete roof-adjacent channels, each with its own specific sun exposure, leading to slightly different microclimates and requiring specific selections of plant species. We thus prepared an imitation of a karst garden and forest undergrowth. In the exterior part, on the school courtyard, where the amphitheatre is intended for students, we planted shade-tolerant species that are easy-grown and do not require special care. All species selected for planting were plants from our native flora, because we wanted to educate students and teachers about Slovenian biodiversity. The roof gardens and the garden in the courtyard were also used as to aid teaching in botany classes. We explained the concept of planting to the students, who then marked the plants with labels themselves. As part of the teaching/learning project, each student chose a specific plant species and monitored its phenological stages, and finally prepared a seminar paper. Additionally, they presented their findings to their classmates in the form of an exhibition. With such collaboration, we expanded the activities of the Garden beyond our boundaries, and arranged a vivid teaching aid for botany classes for high school students.
Keywords: roof garden, education, different habitats.

The role of the Buda Arboretum in landscape architecture education in Hungary
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Landscape Architecture education in Hungary is in an exceptionally privileged position, as its campus is located within the boundaries of a 7.5-hectare thematic plant collection. The Arboretum provides an excellent opportunity for students to prepare for a wide variety of courses and subjects both during and after lectures.

The arboretum has a wide variety of microclimates, including some areas with climatic conditions unique in Budapest. Therefore, species with very different demands can be grown and displayed here. Apart from providing morphological knowledge, the presence of old plants (the oldest Parrotia persica specimen of the country, for example) helps students visualize how different taxa look in later stages of their lives, which vastly benefits their long-term approach to planting design.

The Buda Arboretum does not only play a major role in subjects on plants themselves (Dendrology 1-3), but also in primary (Geodesy, Free-hand drawing), management (Landscape Construction and Management) and design courses (Dendrology 3, Planting Design). The foreign-language courses of the Master of Landscape Architecture programme and ERASMUS subjects are also largely based upon the Arboretum and its plants. The garden also hosts courses on the subjects of tree surveying, tree care and maintenance, soil studies, environmental education and environmental psychology, all of which contribute to the multi-disciplinary training of landscape architects of all levels at Szent István University.

Keywords: Buda Arboretum, landscape architecture, Szent István University

The International Plant Exchange Network (IPEN): a botanic gardens´ approach to cope with the Nagoya Protocol of the Convention on Biodiversity

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The International Plant Exchange Network (IPEN) was launched in 1998 as a Botanic Gardens´ strategy aiming at: (1) complying with CBD requirements, especially those related to Access and Benefit Sharing issues; (2) developing and implementing material transfer systems for non-commercial purposes for Botanic Gardens which are transparent and trustworthy to providers of plant genetic resources; (3) securing the sharing of benefits with providers; (4) creating confidence in the work of Botanic Gardens worldwide and thus facilitate access to genetic resources; (5) mitigating negative effects of administration potentially caused by new legally binding material transfer or documentation regulations. (6) creating unique identifiers for plant material exchanged between Botanic Gardens. Today IPEN has 189 members from 32 countries.
Since Oct. 12, 2014, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in accord with the Convention of Biological Diversity" (NP) has come into force. This has serious consequences for scientific institutions (including Botanic Gardens) when trying to acquire new material for research, conservation or public outreach. IPEN and its coordination group have reacted to these challenges by informing Botanic Gardens about the NP and its potential implications for BGs and adjusting IPEN to cope with the NP, especially by developing a new Code of Conduct taking the NP into account. The new IPEN is now open for new members.
The talk will present the new elements of IPEN and hopefully will encourage a vivid discussion.
Keywords: International Plant Exchange Network, IPEN, Nagoya Protocol, CBD

"Hippocrates Botanical Gardens" Network

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The non-profit organization "Hippocrates 2500 years" is committed to researching, studying, promoting and disseminating Hippocrates' work but it largely involves the creation of an international renowned research centre of the more than 270 herbs that Hippocrates cited in his books and used in the treatment of his patients as well as the foundation of Hippocrates Botanical Gardens (HBGs) consisting of the above medicinal plant species.
As tribute to the "Father of Medicine", "Hippocrates 2500 years" has created many HBGs: initially the HBG of Kos which is Hippocrates' homeland (near the sanctuary of the Asclepius archaeological area) in collaboration with the International Hippocratic Foundation of Kos; another one on the island of Limnos in collaboration with the Department of Food Science and Nutrition of the University of the Aegean; another HBG in the surrounding area and on the rooftops of the bioclimatic headquarter building of Apivita S.A. in Markopoulo near Athens and many other smaller gardens (among them the HBG of Ginza in Tokyo). All the HBGs are open to the public and provide signs equipped with a QR code system that gives the visitor access to plant knowledge database. The available information is updated according to the progress of the study regarding the composition and the medicinal uses of each herb. In the larger HBGs guided tours take place. Among the information given is the reference of these herbs in Greek Mythology and History. An Herbarium as well as a Seed Bank of Hippocratic plants have also been established. Four of the Gardens are official members of BGCI.
The aim of "Hippocrates 2500 years" is the creation of Botanical Gardens in all locations where great sanctuaries of Asclepius are situated. Thus, a new HBG including the medicinal plants of Greek antiquity will be established at Epidaurus archaeological site. The establishment of dedicated Sections to Hippocratic Plants in existing Botanical Gardens all over the world is also an important goal. Main sponsors of "Hippocrates 2500 year" are Apivita S.A. and Apigea S.A.
Keywords: Hippocrates, medicinal plants, Asclepius

Information handling related to plant materials in botanic gardens

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Botanic gardens are defined as institutions holding documented plant collections. However, the ways and methods of documenting changed immensely over the last decades. Also, since the Convention on Biological Diversity (CBD) entered into force the responsibility of botanic gardens has grown greatly. The information related to plants has more important role within the collection and in plant exchanges, communication between institutions either. To serve that role there have been several solutions developed for data handling. From the simple spreadsheets to so called 'collection management' software are in use. The data collected at

garden level, or extracts of it may build up a local, national or regional database or network fulfilling the related action points of the Global Strategy for Plant Conservation (GSPC). Most of them are available on-line.
Adaptation of the CBD and its proceeding regulations has also brought new tasks in plant related documentation, the documentation of the exchange of genetic materials. The International Plant Exchange Network (IPEN) and its system are constructed to support this process. This voluntarily joined network reached a good number of gardens across Europe and can be detected in the seed lists of those gardens. It provides a good method to track back the original source of plant materials being exchanged.
The voluntarily applied documentation of exchanges is to be extended or replaced to a more regulated form, which is according to the Nagoya Protocol. Its implementation and practical use is being worked out and will be in place in the not too far future.
Keywords: data base, plant exchange, CBD

Vilnius University Botanical Garden: To improve the quality of plant collections
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Located in Vilnius City at two sites he Botanical Garden of Vilnius University currently holds almost 199 hectares of land. The main part of the garden (191.5 ha) is located on the north-eastern outskirts of the city (Kairėnai), while the historic part of the garden (7.35 ha, est. 1919) remains in downtown Vilnius. Today, in these two plots of land 10,956 taxa are cultivated (represented by 12031 accessions of living plants). The collections contain a wide array of thematic groups, which today may be divided into 3 larger and 14 smaller groups. This complexity has led to the accumulation of a fair amount of information both historical and cultural, and the development of collections that require specifically formulated management. In order to bring all management requirements for the various collections under controll, an entire system of measures have been introduced to ensure high quality standards for the garden. To this end we 1) created a single database of plants and launched it online (http://botsodas.lt/indexplantarum); 2) unified the plant labeling system that includes the use of QR codes; 3) established a policy development of plant collections; 4) begun mapping the garden plants (using both aerial photographs and GIS software system) to create a common, interactive garden map linked to the garden Plant Database.
Keywords: plants, quality, collections

***Larix* genus in botanic garden of Klaipėda University – West Lithuania**
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The Botanical Garden of Klaipeda University (BG) is located in Western Lithuania, in the northern part of the Klaipėda city, in the valley of the Dane River, near the Baltic Sea (about 3.5 km). It was established in 1993, and since 2002 it has dendrological park status. In general, the area is of 9.3 hectares. The purpose of the Botanical Garden is the conservation of the genetic resources of herbaceous and woody ornamental and medicinal plants in the collections. Compared with other parts of Lithuania, the climatic conditions differ by having a longer growing season. Therefore, these are favourable conditions for plant adaptation. Since 2005, the Botanical Garden is a member of the IPG. Since 2002 it participates in a seed exchange programme and published an annual *Index seminum*. Introduction of *Larix* species in Lithuania was launched in the middle 19th century as a valuable industrial and decorative species. Forestry plantings of *Larix* in our forests began about 160 years ago. In Lithuania, larches are winter hardy and are cultivated in mixed stands associating with *Picea abies*, *Pinus cembra*, *Pinus mugo*, *Fagus sylvatica* or *Abies alba* and can also occur in pure stands. In our botanic garden's dendrological section 16 taxa of *Larix* P. Mill. are grown: L. *sibirica* Lebed., *L. decidua* Mill., L. *kaempheri* (A.B. Lambert.), L. *kurilensis* (Mayr) Cin., L. *laricina* (Du Roi) K. Koch, L. *gmelini*, L.*rossica*, *Larix x marschlinsii, Larix decidua* Mill. 'Pendula', *Larix decidua* Mill. 'Fastigiata' *Larix decidua* Mill. 'Horstman Recurved', *Larix kaempferi* (Lamb.) Carr. 'Diana', *Larix kaempferi* (Lamb.) Carr. 'Blue Dwarf', *Larix kaempferi* (Lamb.) Carr. 'Pendula', *Larix kaempferi* (Lamb.) Carr. 'Jcobsen Pyramid', *Larix gmelinii var. olgensis*. 6 taxa of larches are specific to Europe, 12 to Asia (Japan) and 2 to Russia (Siberia). The age classes of these larches are different, the oldest ones are *L. sibirica* and *L. decidua* — 19 years old. In the annual *Index seminum* we could include *L. kaempferi* seeds beginning in 2003. *L. sibirica* Lebed. and *L. decidua* Mill. have been included from 2002, but in 2003-2006, 2009, 2015 and 2016 were not present on the list. *Larix decidua* Mill. 'Fastigiata', *Larix kaempferi* (Lamb.) Carr. 'Blue Dwarf', 'Pendula', 'Jcobsen Pyramid', *Larix gmelinii var. olgensis*, *L.rossica* and *Larix x marschlinsii* have been growing here from 2003 – 2005, but have not produced cones/seeds yet.
Keywords: Larix, Botanic garden, seed, taxa.

Section IV. - Conservation

Conservation of plants by translocation: some examples from the practice of botanical gardens

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In accordance with the terminology of IUCN, the translocation, or living organisms displacement from one territory to another suggests three types of processes: introduction, or movement of organisms beyond their historical natural range; reintroduction, or deliberate movement of the organism into that part of its natural area, from which it disappeared in historical times; restocking, or individuals' movement to reinforce existing populations. The first, during recent years - the second and third directions are widely being used by botanical gardens allover the world for biological diversity conservation.
Botanical Garden of Samara University has been conducting introductory tests numbering more than 2000 taxa of the world' dendroflora, and demonstrated the survival in its new region for 1000 taxa. This includes some invasive woody species ("biological pollution"), primarily Acer negundo L., or to a lesser extent Parthenocissus quinquelfolia (L.) Planch., Elaeagnus angustifolia L., Ulmus pumila L. Our ways of restocking of existing populations and reintroduction aimed at the conservation of rare species includes 11, mainly non-woody, species since 2008. 8 of these are included in the Red Data Books (Samara Region and others), namely Iris aphylla L., I. pumila L., I. sibirica L., Juniperus sabina L. Clematis integrifolia L., Polemonium caeruleum L., Dictamnus gymnostylis Stev., Lilium martagon L.; 3 of them are classified as "disappeared" in the Red Data Book of the Samara Region: Iris halophila Pall., Paeonia tenuifolia L., Euonymus europaeus L.). The field monitoring showed satisfactory state for 5 species in natural biotopes, and a good state for 3 taxa. Paeonia tenuifolia L. demonstrates massive flowering, seeding, the presence of self-sowing, and Euonymus europaea L. began its flowering and fruit formation. These species can be considered restored in the Samara region.
Keywords: plant conservation, introduction, reintroduction

The European Native Seed Conservation Network (ENSCONET) Consortium

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As a follow-up to the EU-funded project ENSCONET (running 2004-2009), 31 organizations from 17 European countries decided to continue their seed conservation related activities and, in 2010, established the ENSCONET Consortium coordinated by the Millennium Seed Bank, RBG Kew.
At its last general meeting at the 6th Global Botanic Gardens Conference in Geneva (June, 2017), the work of the Consortium for the near future was prioritized as follows:
1) contributing to targets 8 and 9 of the GSPC in Europe by encouraging the upload of data about seeds stored in European seedbanks to the ENSCObase system and by using this data for national and regional gap analyses and collection plans;
2) strengthening communication and links within the network and with other conservation and plant biology related institutions and stakeholders;
3) promoting seed research activities and the exchange of seed conservation related knowledge, best practices and experiences; thus ensuring that seed collections are suitable and available for conservation projects including seed-based restoration activities;
4) seeking funding opportunities, especially on national and regional levels, to enable the Consortium to carry out these tasks.
Keywords: GSPC targets 8 and 9; conservation; seed collection, storage and curation; ENSCObase; seed research; ENSCONET Consortium

Ex situ conservation in the Botanical Garden of Eötvös University

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Botanical gardens were the first institutions where people dealt with ex situ conservation around the world. The Botanical Garden of Eötvös University (ELTE Füvészkert) is the oldest botanical garden in Hungary, founded in 1771 to educate the medical students, then the garden was enriched by ornamental plants. During his many travels 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. In the fifties of the 20th century our director, Szaniszló Priszter was among the first who investigated the propagation possibilities of rare and endangered plants in Hungary. From 1987 up to now we have had four ex situ conservation projects. In the ELTE Füvészkert

we cultivate 8259 plant taxa, including 336 protected 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 (e.g. *Primula farinosa*) or interglacial relicts (e.g. *Carpinus orientalis*). 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 phytogeographycally important: these may be Pannonian endemic or relict endemic species (e.g. *Ferula sadleriana*) or Pontic (e.g. *Dracocephalum austriacum*) floristic elements, which are distributed to East Europe and West Asia. The ex situ conservation programs have different means and targets, mainly introducing endangered plants, but some of them undertake developing an „ex situ population" and re-introduce the plants to their former natural habitats. The ELTE Füvészkert has done such reintroductions in some cases (e.g. *Telekia speciosa*) and plans to do this with two other species (*Crepis pannonica, Senecio umbrosus*) in cooperation by the appropriate national parks. Every year we organise events related to conservation (e.g. International Day for Biological Diversity); we established a „green school" (Grüne Schule) to educate the children, similarly to that in Palmengarten der Stadt Frankfurt am Main. The ELTE Füvészkert is a member of certain international (IPEN, BGCI) and national (MABOSZ) organizations and takes part in domestic and international sharing/exchanging its plant resources and data.

Keywords: ELTE Füvészkert, plant introduction, reintroduction, protected plants

Protection vs. development? Sustainable development of the 1021 years old Benedictine Monastery of Pannonhalma

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The World Heritage Site in Pannonhalma is affected by many different land-use methods. The most important roles must be considered in all plans, strategies and cultivation schemes, whilst minor functions can help the site to develop as a living entity.

The habitat structure of the World Heritage Site is very complex. In the interest of understanding this complicated structure, it was not enough to make environmental surveys, but was also important to analyze the historical land-use methods and spatial structures of the area. The results provided by these historical studies give us clear answers to many of the questions presented by the current habitat and land-use structures that sit side by side.

To understand and develop the site in a sustainable way it is absolutely necessary to have a firm knowledge about the past. In the last 1000 years it was the Monastery's farming system which dominated the façade of the surrounding lands – this is why we made the complex survey of the natural environment.

The fact, that some parts of the Pannonhalma Landscape Protection Area were under intense cultivation 50-60 years before, proves that it is possible to make decisions on the development of protected areas in this time period as well. From an environmental aspect the conditions, which originated from the abandonment and dis-use of rural areas, can be expressly useful: lots of lost natural riches can be rediscovered.

The results proved that even 100% human-made habitats can play an extremely important role for local flora and fauna. In a well constructed and accurately sustained land-use system, the uses and protection processes are not antagonists, but strengthen each other.

Keywords: Pannonhalma, protection, development, world heritage

Activity of Kaunas Botanical Garden of VMU on the protection of endangered and rare plants of boreal forests

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Boreal forests are intensively managed to maximize wood gathering notwithstanding the importance of maintaining biodiversity. The preservation of endangered and rare plants has become an important but complicated task in times when drastic forest ecosystem changes are observed following clearcuttings. The Kaunas Botanical Garden of Vytautas Magnus University implements the MEKODINA project (grant No. SIT-1/2015 funded by the Research Council of Lithuania) that includes the task of protecting rare understory plants after clear-cuttings.

We aim at determining the "minimum required conditions" for the survival of rare and endangered species in the clearcut forest areas. While implementing the project several new localities of rare and protected plant species were discovered which led to new sets of information about *Arnica montana* L., *Pulsatilla patens* (L.) Mill., *Silene lituanica* Zapał., as well as *V. myrtillus* var. *leucocarpum* Haussm. and were included in the protected species information system (PSIS). Individuals of *A. montana* and *P. patens* that are recorded in the Lithuanian Red Data Book were found only in very few isolated plots. Our investigations corroborated the

crucial influences in the development of juvenile populations of *Lycopodium annotinum* L., *L. clavatum* L., *Diphasiastrum tristachyum* (Pursh) Holub, and *D. complanatum* (L.) Holub. We ensured the protection of these archaic plants by marking their habitats. The conditions of other plant populations were evaluated and means for their protection were proposed. - The endangered plant species need careful restoration activities that may include population translocations or re-introductions, in order to prevent their extinction. We will continue investigations on ex situ propagation and preservation of rare and endangered plants at a specific part of the living collections in Kaunas Botanical Garden.
Keywords: forest, rare plant, population

Long-term monitoring in the Soroksár Botanical Garden tracking resilience and change of natural Pannonian habitats
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The 54 years old Botanical Garden of Soroksár is situated at the periphery of Budapest, on the edge of the Pest lowland area, on sandy and alluvial deposits of the Danube river. The garden has a harsh continental climate with cold, windy winters and hot, dry summers. The Garden is famous for preserving natural sites and reconstructed vegetation spots that are remnants of the Pannonian forest steppe. The 12 hectare fen community, has been preserved in its natural state while the lake and the surrounding wet habitat, the inland sandy dune as well as the naturally regenerated pedunculate oak forest are reconstructed habitats. In March 2015 we started a long-term monitoring in five sites including the Pannonian fen community and the surroundings of the lake. Five poles were fixed permanently and high resolution pictures are taken from the same position, twice per week all over the year, at the same period of the day. Up to know two years climate data from the meteorological station are evaluated with the collected and processed photo records tracking population dynamics, floral biodiversity and phenology. To get an idea on the changes over space and time in this highly protected area we consider important the long-term monitoring in places that do not change significantly in small time scale. We need to understand stability and its reasons, as much as we need to understand change and its causes in the time of the ongoing climate change to take the best managing strategy for preservation. Slide shows will be presented.
Keywords: fen meadow, photo records, meteorological data

The conservation of the Romanian flora in one botanical garden - the first project of this kind in the country
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The ”Vasile Fati” Botanical Garden Jibou (Sălaj County) is the second largest botanical garden in Romania (circa 27 ha). Here we initiated one of the most important conservation projects related to the native flora of Romania. The area allocated for conservation the Romanian flora covers more than 3 ha, so we decided to represent all the different habitats of the country. Different kinds of species need different kinds of habitats, which requires a lot of work and planning. The final result will consist in representing all the 372 types of habitats encountered in Romania.
The area granted for the Romanian Flora was initially covered almost entirely with forest, therefore we had to transform the landscape, which fortunately is uneven. The work started in 2013 and so far, we managed to realise more than 40 % of the project. First, were designed the rockeries similarly to those encountered in the Carpathians and Dobrudja. We used limestone and rocks with acid substrate. Next we created two major peat bogs. Ongoing works consist in planning the continental sand dunes, sea shores, steppes, swamps and lakes.
Of the more than 3000 species of the Romanian flora, the Botanical Garden Jibou shelters more than 800 taxa. Most of them are obtained from seeds collected in the wild. Some Carpathian and Transylvanian endemic species are found in the rockeries (*Silene zawadzkii, Thymus comosus, Campanula carpatica, Sesleria heufleriana, Onosma pseudoarenaria* etc.). The peat bogs shelter rare species such as *Drosera rotundifolia, Andromeda polifolia, Vaccinium oxycoccus, Lysimachia thyrsiflora, Viola epipsila, Typha shuttleworthii, Betula nana, B. humilis* etc. *Corynephorus canescens* is growing on the sand dunes, while *Dianthus nardiformis, Sempervivum zeleborii*, and *Iberis saxatilis* are present in the Dobrudja rockery habitats. From the rare species growing in the botanical garden, Fritillaria meleagris is an example of a successful conservation project thanks to the work of our researchers.
Keywords: Romanian flora, conservation, habitats, botanical garden

Living collections of tropical orchids in Ukraine: research, educational and conservational missions
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The M.M. Gryshko National Botanic Garden of the National Academy of Ukraine was established in 1935 and opened for the public in 1964. The 130-ha Garden's collections comprise more than 14 thousand species and cultivars including outstanding collections of woody and shrubby temperate plants, annual and perennial ornamentals, medicinal plants as well as the unique collections of tropical plants.

Ex situ conservation of tropical orchids threatened with extinction within their native ranges is one of the highest priorities on the research agenda of the National Botanic Garden. The orchid collection, currently comprising approximately 450 species in 170 genera, native to South-East Asia, South and Central Americas, with a few genera from Africa, has been a main focus of the Garden's Living Collections. To promote long-time ex situ conservation of orchids, the research activities at NBG focusing on the following issues: studies of developmental biology of orchids (with special reference to reproductive biology of epiphytes and lithophytes as the most vulnerable groups); investigation of structural adaptations and life histories of orchids to survive under a wide range of different habitats; development of in vitro orchid propagation procedures; assessment of biological activity of various orchid plant parts, including seeds; creation of orchid displays as an efficient tool in raising public awareness in issues related to conservation of orchid species that suffered over-collecting, global climate changes and irreversible loss of their natural habitats.

A display glasshouse "Orchidarium", opened for public at NBG in 2005, is a logical end-point of long-time dedicated investigations of orchid plants in their native habitats as well as under glasshouse conditions. This exhibition highlights the diversity of orchid plants, their uniqueness and the ways how these plants can be used by people, and provides education on sustainable living.

To conclude, the NBG's living orchid collections are used as valuable sources of material for diverse scientific projects, conservational and educational programmes linked to public education on plant conservation and improving human attitude to nature.

Keywords: orchids, collections, *ex situ* conservation, exhibition glasshouse

The display group of „serpentine plants" at the Botanical Garden of the University of Vienna, Austria

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Austria harbours several areas with serpentinite, an ultramaphic type of bedrock showing chemical and phyiscal characteristics that are quite hostile for many plants. Consequently, these areas are charcterized by a very specific type of dry area vegetation. Plant species occurring in such habitats have to cope with difficulty in nutrient uptake. Despite that, there is a number of (sub-)species completely restricted to sites with serpentinite soils.
Since 1990, the Botanical Garden of the University of Vienna has been establishing display groups of Pannonian dry area vegetation characteristic to eastern Austria. One of such developments was the layout of a display showing plant species typical for serpentinite rocks.
To create the display area, most of the existing vegetation was removed. The surface was covered with mypex fabric and topped by a layer of sieved serpentinite rock and a layer of ground soil transported from an original serpentinite site and mixed with ground soil from the Botanical Garden.
Prior to this, seeds and plants of „serpentine taxa" collected in situ over a couple of years were cultivated in pots and planted at the display group in the autumn of 2015.
The plants displayed include threatened species such as Notholaena marantae and Sempervivum pittoni (endemic in Styria).
Experiences for the first two years: So far, the display area looks fine; there are no losses except one plant of *Sorbus aucuparia*. Two individuals of *Pinus sylvestris* left from the original vegetation at the site had died. Already in 2016 some species begun reproducing (selfseeding). Due to the shallow layer of soil on the mypex fabric, the plants need watering in periods of extreme droughts.
Didactic background and cooperation: At the site, information sheets provide background information on the development of the group and on specific plant species. In the framework of regular guided garden-tours the purpose and characteristics of the display group are also explained. In 2016, the display group was subject of a master thesis. Cooperation with the University of Applied Sciences, Vienna („Boku") has been initiated to undertake further research on soil conditions and accumulation of heavy metals in serpentinite plant species.
Keywords: serpentine flora, ex situ conservation, public outreach

Contribution of seed banks across Europe towards 2020 GSPC targets 8 & 9, assessed through the ENSCONET database

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To meet the international biodiversity targets of the Global Strategy for Plant Conservation (GSPC), it is important to assess the success of coordinated ex situ plant conservation initiatives such as the European Native Seed Conservation Network (ENSCONET), which operated from 2004 to 2009, and the ENSCONET Consortium, which was established in 2010. In particular, analysis of the ENSCONET database (ENSCOBASE) indicates that ex situ seed banks (especially of Eastern and Central European countries) have been making significant progress towards meeting GSPC targets 8 (at least 75% of threatened plant species in ex situ collections, preferably in the country of origin, and at least 20% available for recovery and restoration programmes) and 9 (70% of the genetic diversity of crops, including their wild relatives and other socio-economically valuable plant species, conserved, while respecting, preserving and maintaining associated indigenous and local knowledge) for native European species. However, the infraspecific diversity of threatened species stored in ENSCONET seed banks needs to be increased to meet research and conservation objectives.
Keywords: ENSCONET, Global Strategy for Plant Conservation, ex situ seed conservation, infraspecific diversity

Higher education at botanic gardens: The HEI PLADI Project

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HEI-PLADI (Higher Education Innovation in Plant Diversity: flexible learning paths for emerging labour market) project was funded by EU Programme Erasmus+. This project relays on a constructive cooperation between seven different educational institutions, botanic gardens and a research institute from Italy, Portugal, Malta, Bulgaria, Poland and Greece.
The main goals of HEI PLADI are supporting implementation of reforms in line with the 2011 EU Modernization Agenda's priority areas; development of a European Area of Skills and Qualifications; enhancement of digital integration in learning, teaching, training and youth work at various levels.
Target audience: undergraduate and PhD students interested in Plant Biodiversity, Conservation, Management and Sustainability.
As a main output the HEI PLADI project provides teaching materials available as "open learning objects" in an e-learning platform for a wide number of professionals beside students as well as seven short-term training activities as part of the "flexible blended pilot program" which includes field works, field visits, practical and laboratory activities focused on developing skills and deepen knowledge on topics treated in the e-learning courses.
As a long-lasting result project promotes the ideas that conservation and sustainable utilization of plant diversity have a pivotal role in contributing to food and nutritional security. Furthermore, the Convention on Biological Diversity (CBD), the Global Strategy for Plant Conservation (GSPC) and International Agenda for Botanic Gardens shall be recognized as important documents to build scientific and technological skills in plant taxonomy, in situ biodiversity management and ex situ conservation of both wild and domestic biodiversity.
Keywords: Botanic Gardens, biodiversity, management, education

Educational activities and events in the Botanical Garden of the Faculty of Science in Zagreb

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The organized guided tours of the Garden for children and general public are the oldest of our educational activities in the Botanical Garden of the Faculty of Science. Recently, numerous educational exhibitions were mounted and workshops organized in the exhibition pavilion after the renovations in 2007. The Garden undertakes coordination and participation in the national event called *Week of Croatian Botanical Gardens and Arboreta*, which takes place annually in May. During the Week, hundreds of visitors participate in various workshops, attend the lectures or listen to concerts free of charge. The Children's Flower and Vegetable Garden, opened in 2013, where the children from the nearby primary school can learn how to grow their own vegetables and flowers, has proven not only popular but also of great educational value. Another very popular event is visiting the Victoria House and watching Victoria cruziana flowers changing colour during the night. In addition, horticultural lectures and presentations in the Garden are organized parallel with the annual flower show Floraart in Zagreb.
Keywords: education, workshop, exhibition

2017 Update of the 2013 Strategy for Plant Conservation in Botanical Garden of the Faculty of Science, University of Zagreb

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Zagreb Botanical Garden of the Faculty of Science is the main Croatian institution actively participating in conservation of endangered plant species according to GPSC 2020, by maintaining live specimens, banking seeds, researching germination ecology and introducing plants to the horticultural trade. Since Croatia joined EU in 2013, the main focus of our work are the Natura 2000-species living wild in our country.
Research on germination ecology of Croatian Natura- and statutorily strictly protected species (*Degenia velebitica* (Degen) Hayek, *Ligularia sibirica* (L.) Cass, *Klasea lycopifolia* (Vill.) A. Kern., *Scilla litardierei* (Breistr.) Speta, *Genista holopetala* (Koch) Bald. and *Adenophora liliifolia* (L.) A.DC.), collected in the wild according to the special permits obtained from the Croatian Ministry of Environment and Nature Protection, was finished successfully. Seedlings of all investigated species were grown to be planted in the Botanical Garden rockeries with collections of indigenous plants, as required by the permits.
For every species grown in such manner, further cultivation requires finding the best planting position and creating the most natural conditions for them to thrive. Such a spot should have the potential to effectively conserve the particular species, as well as to continue the study of its life-span and to promote public awareness on the importance of preserving plant diversity.

Building the necessary capacities for the implementation of Strategy for plant conservation and preservation of threatened species from the wild in the Botanical Garden collections is our continuous mission.
Keywords: Croatia, Botanical Garden, Natura 2000, conservation

Multiplication of seeds and ex situ conservation of *Pulsatilla georgica* Rupr. (Ranunculaceae)
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The work deals with the studies on *Pulsatilla georgica* Rupr. (EN) – a Red List species, primarily having the status of conservation, its biological peculiarities, seed processing, propagation by seed, and ex situ conservation activities.
With the purpose to determine the reasons for the decline of *P. georgica*, the following has been studied: sequential progress of growth and development, degrees of phenophase, terms and characteristics; formation of generative organs and degree of fertility, pollination-fertilization process; ways and types of pollination.
The terms of seed maturity were defined and duration of the life cycle was determined; Ratio of generative and vegetative propagation in the resettlement of the species; Seed capacity of potential and real seed reproduction have been assessed. Based on the obtained data, we concluded that the target species is adapted well to the environmental conditions. Therefore, the reasons for the decline of *P.georgica* populations should be mainly attributed to abiogenic factors.
With the conservation in mind, the seeds of P.georgica were collected in its natural habitat and stored in both the Seed Bank of the Caucasus and in the Millennium Seed Bank (UK). Collection of live plants, as well as surplus seed were collected, and stored in a local „backup" seed bank, all these serving future reintroduction in nature.
Keywords: *Pulsatilla georgica*, Seed, Conservation

Eco-biological study and ex situ conservation of the Georgian endemic species *Aquilegia colchica* Kem.-Nath.
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Preservation of the gene pool of this endemic species is of high conservation priority, its ex situ conservation is the precondition for the protection of biodiversity. For the research we selected the locally distributed Georgian endemic species – *Aquilegia colchica* Kem.-Nath. (Helleboraceae), which has the primary conservation status. Complex eco-biological research of the target species, and its ex situ conservation was accomplished using methods by Rabotnov and Baskin-Baskin.
The research has shown the following:

- *Aquilegia colchica* has normal generational function, specifically, it has high energetic potential of male generative sphere;
- The species is characterized by protandry;
- The number of generational shoots and flowers seems to be a comparatively variable morphological trait. Depending on age of the plant the number of generational shoots changes. As for the number of flowers, it depends on the length of the shoot and its branching;
- The species is characterized by high productivity (each plant produces 1,260 seeds) and speedy germination (14-18 days). Best results were received during an autumn sowing – 85% of seeds germinated. During spring sowing germination was faster, but the percentage of sprouts was lower – 72%;
- The longer the seeds are preserved, the sprouting energy becomes more limited;
- The species is characterized by complete ontogenesis, which includes 4 periods and 8 subperiods;
- Plants developed from seeds start blooming in the third year;
- The seed retains germination capacity even after a year.

The experimental living collection was established on the territory of the National Botanical Garden of Georgia. The seed is preserved in the Caucasus Regional Seed Bank. Duplicate collection was sent to the Millennium Seed Bank (MSB), UK.
Keywords: ontogenesis, ex situ conservation, seed bank

Peculiarities of propagation and ex situ conservation of Georgian endemic species *Campanula kachetica* Kantsch.
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Campanula kachetica Kantsch. – the Kakhetian bellflower – is a species of primary conservation status, included in the Red Data List of Caucasus Plants. It is endemic to Georgia and has a very limited distribution range. Currently *Campanula kachetica* is present in a single population, located in East Georgia on limestone rocks of Jurassic period.

For the first time we have carried out a complex study to reveal the propagation and self-regeneration capacity of *Campanula kachetica*, its biological peculiarities, productivity of seed, its seed viability, conditions and terms of seed germination, viability of seedlings, seasonal rhythm of seed development, conditions of seed storage, seed storage behaviour – quality and germination capacity of the seed stored in the seed bank for four years.
Our study of the self-regeneration capacity of the seeds collected from open-pollinated plants, as well as seeds produced by isolated individuals revealed a really high percentage of germination – from 85 up to 95%. When sown in soil, the species passes through the complete ontogenetic cycle in two years. Seeds stored in the seed bank reveal high germination capacity.
Our studies have shown that in its natural habitat *Campanula kachetica* propagates mainly vegetatively and rarely by seed. For the seed to germinate it is necessary to fall into favourable environment and under proper climatic conditions; otherwise propagation capacity by seed is quite high in *Campanula kachetica*. The species is characterized by biological plasticity and a labile character of pollination. In particular, besides allogamy, facultative autogamy is characteristic to the species.
The obtained data together with other criteria are important for the evaluation of natural population of a target species and development of methods for sexual propagation of the species in its natural habitat.
Ex situ conservation work has been carried out. Seed collections of *Campanula kachetica* are preserved in the Caucasus Regional Seed Bank and duplicated to the Millennium Seed Bank of the RBG, Kew.
Keywords: *Campanula kachetica,* germination, conservation.

Ex-situ conservation of some medicinal plants of Georgia
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Georgia's flora is estimated at 4130 vascular plant species, one fifth of which are endemics. Flora of Georgia is known to contain a remarkably high number of species of medicinal value, with over 700 species utilized in Georgian traditional medicine and 200 taxa registered in the official pharmacopoeia.
Hundreds of Georgian economical plant species are threatened with extinction or exposed to risk of genetic erosion. The vast majority of medicinal plants in Georgia are harvested in the wild and in some cases are even overexploited. Due to economical difficulties in Georgia, the wild flora and habitats are under the permanent anthropogenic pressure such as tree felling, overharvesting of wild species, etc. that cause deterioration and fragmentation of habitats and extinction of many species of medicinal value.
It is of urgent necessity to take conservation measures for these species through both ex-situ and in-situ protection methods. For this purpose it is of critical importance to collect data on the distribution of the above species and on the vitality and fertility of their populations.
In 2001, the Caucasus Regional Seed Bank (CRSB) was established as part of a collaborative project between Georgian botanists and colleagues from Missouri Botanical Garden "Sustainable Use & Conservation of Medicinal Plant Resources in the Republic of Georgia". As an output of the above project, seeds of 150 endemic and rare medicinal plants were collected and deposited to the CRSB. These are species that belong to the genera Galanthus, Cyclamen, Paeonia, Colchicum, Dioscorea, Salvia, Gymnospermium, Helleborus, Anthemis, Nepeta, etc.
The next step in the further developing of the Caucasus Regional Seed Bank was collaboration with Kew's Millennium Seed Bank Partnership (MSBP) which was commenced in 2005 and continues to date.
Georgian botanists are keen to gather information on 700 medicinal species occurring in Georgia, collect the seeds and deposit them both to the CRSB and MSB.
Keywords: ex-situ conservation, medicinal plants, seed bank.

Habitat restauration of old-fields in Körös-Maros National Park (Hungary) with ex situ propagation and planting of loess grassland species
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In recent decades the ex-situ conservation of endangered species has become one of the most important tasks of botanical gardens because of worldwide loss of habitats, increasing vulnerability of plant species and decreasing biodiversity.
The SZTE Botanical Garden has recently carried out a project in the territory of the Körös-Maros National Park. Tasks included collection of propagulums from natural loess grasslands, ex situ propagation and plantation of at least 3000 individuals of rare and protected loess plants to old-fields with different ages.
The collection of the propagulums was carried out during 2011. The outdoor propagation of 29 species was started with seed-sowing in the autumn of the same year. The seeds of 21 species were sowed in a light-chamber in March of 2012. Outplanting was carried out in October of 2012. The propagation was successful; the end result was 5914 individuals encompasssing 32 species.
Four, partly restored former arable fields were choosen as planting sites in the northern part of the National Park. The plantings to the four sites were organized in a pre-arranged matter; individual plants were planted

out in a grid system of 5 m x 1 m on the suitable parts of the old-fields. Outplanting was made by imitating the spatial pattern of a natural loess grassland community. Individuals of abundant species (*Silene otites, Phlomis tuberosa, Senecio doria, Thalictrum minus, Filipendula vulgaris*) were planted to each sites, while species with low abundance (*Ajuga laxmannii, Astragalus austriacus, Peucedanum alsaticum, Carduus hamulosus, Scutellaria hastifolia*) were planted to only one site. The condition and survival of plants was monitored yearly between 2013 and 2016 in the experimental sites, the number of new individuals was recorded.
According to our four-year data the plantation experiment was successful; out of 32 planted species, 29 survived and reproduced in all habitats, the survival of one species was uncertain and only individuals of 2 species disappeared.
Keywords: Körös-Maros National Park, habitat restauration, loess grasslands

Changes in the Bryophyte flora in Botanic Garden of Eszterházy Károly University (Hungary)
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The 1-ha protected area belonging to the Botanical Garden of Eszterházy Károly University is situated in the northern edge of Eger. Recently, a garden reconstruction program took place in the botanical garden supported by a KEOP project. As a consequence some microhabitats disappeared; changed or got disturbed while during project new habitats were also formed (a swamp garden, new rocky grassland, central space, and new patches).
More recently, two research efforts were made to check the bryophyte species in the botanical garden: one investigation was started before the reconstruction took place and one after the works ended.
The results show that several species disappeared from the previously known microhabitats but also new species occurred in the new habitats created in the garden. As an example, *Homalothecium lutescens* formed great cushions in-between the grass species but after making a swamp there was no habitat for the species. As a parallel process, new species occurred on the wet surfaces of the swamp garden not seen there before (*Marchantia polymorpha, Physcomitrium pyriforme*). As an example for a regeneration process, *Climacium dendroides* can be mentioned. The distribution area of this species decreased during the works but it survived and shows an expanding presence.
There were no changes in the species composition of epiphytes because the old trees of the garden were not disturbed. The reason for changes in the species composition of the garden was evidently the reconstruction process. The research of the first author was supported by NKFI OTKA 115796 research project.
Keywords: bryophyte flora, disturbance, short-term changes

The occurence of Vinca major policormons in the Soroksár Botanical Garden
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Vinca major is a low, creeping dwarf shrub with overwintering foliage. It is native in the Mediterranean region and frequently used in European gardens for centuries. Therefore it became widely naturalised, but its current alien status in Central European countries isn't established yet.
In Hungary, *V. major* has sporadic occurrences in the wild which is probably due to the illegal placement of the garden waste in forest habitats close to settlements. It has a definitely powerful vegetative reproduction ability and can be self-propagated by the tore down stem pieces.
The species has a large population in the Soroksár Botanical Garden where it was planted shortly after the foundation (1960s). In the present study, we measured and digitalized the exact prevalence data of the species within the Garden and evaluated the possibilities of its escape from there.
We recorded altogether 24 clearly separated patches. Additional 3 points were also recorded, with an area less than 1 m2. These latter spots consist of only about 2–3 individuals. The *V. major* spots cover a total of 6.899 m2 in the Garden, that is, 1.15 % of the whole area. The smallest polycormon is about 1.6 m2, while the largest 1.851 m2 (average 287 m2). The species drifted long distances in the Garden as the maximum distance between the two most distant spots is 1.1 km.
V. major usually occurs under forest plantations, the largest spots are located under *Robinia pseudoacacia* forest, whose foliage provides a fair amount of light to the undergrowth.
V. major has also a 15 m2 spot in the so called "Rock Garden" unit where it grows together with *Geranium sanguineum*. The surrounding trees provide some shadow, but the microclimatic circumstances are not optimal for the species there.
Two large polycormons are bordered by the outer fence of the Garden. So far, the concrete base of the fence prevented the spreading of *V. major*, but its developing sunlight- and dryness tolerance draw attention to the potential danger of its expansion into the Great Hungarian Plain, under Robinia forests.
Keywords: *Vinca major*, large periwinkle, invasion, naturalised alien

The evaluation of rare plant species growing conditions at Botanical Garden of Eszterházy Károly University in Eger, North-East Hungary

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The Botanical Garden of Eszterházy Károly University was founded in 1967, and the full reconstruction of the garden took place between 2011 and 2015. Currently 75 plant species protected in Hungary and species included in the Red list of vascular flora of Hungary are grown in the garden, of which 7 species is strictly protected and 14 classified as critically endangered or endangered.
The condition of these plants is generally good, though as we have expected, some of these plants requiring cooler climate than what we have – plants like *Arabis alpina* L., *Allium victorialis* L., *Cirsium erisithales* (Jacq.) Scop. or *Lunaria rediviva* L., show considerable decline in viable seed propagation or have slower vegetative reproduction than in their native conditions. Surprisingly, certain species such as *Dracocephalum ruyschiana* L. are developing vigorously, even if growing on a sunny place. The population of two orchids, *Orchis purpurea* Jacq. and *Cephalanthera damasonium* (Mill.) Druce, is stable, but fluctuating from year to year. Most of the rarest plants of the garden are native to sunny calcareous bedrock habitats. They are growing well, in some cases with very good seed production and subsequently overtaking the area by producing many new seedlings, e. g. *Hieracium bupleuroides* C.C. Gmel. and *Crepis pannonica* (Jacq.) K. Koch, while others like *Onosma* sp., or *Ferula sadleriana* Ledeb., have prolonged development from seed to adult stadium. Some of the rare plant species typical for grasslands and forest-steppe habitats on sunny slopes of the North Hungarian Mountains have shown very good reproduction potential and even becoming weedy such as *Bupleurum rotundifolium* L., *Silene dichotoma* Ehrh., *Inula helenium* L. or some rare species of arable land margins: *Agrostemma githago* L. and *Aegilops cylindrica* Host., and other species such as *Silene nemoralis* Waldst. et Kit. and *Lychnis coronaria* (L.) Desr. which proved almost invasive in the garden. Generally, these rare species could be potentially used for reintroduction if needed (but with careful attention to accurate documentation of their origin). Other rare plant species that are represented by only a small population, still cannot fulfill similar purposes.
Keywords: conservation ex situ, rare plants, botanic garden

The ELTE Füvészkert (Botanical Garden of Eötvös Loránd University)

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The University of Nagyszombat was founded by Péter Pázmány in 1635 and then in 1771 established its botanical garden, the ELTE Füvészkert which is the first botanical garden of Hungary. The Füvészkert had to move five times. The last occasion was in 1847 to the Festetics-manor house. In these days the manor house provides home for the library keeping botanical, horticultural treasures, herbarium, documents showcasing the Garden's history. It is a place for university and scientific presentations and lectures. The famous Hungarian novel the "A Pál utcai fiúk" (The Paul Street Boys) took place in this garden. In the botanical garden there are greenhouses with 2000 m2. The Palm house is one of the oldest palm house in Hungary, now it has been under Hungarian monument protection and the garden has been under Cultural Heritage Protection since 2006. The Botanical Garden has been national nature reserve since 1960, currently awaits its visitors with about 8,200 plant species and varieties, with a rich cactus, bromeliad, orchid, palm and tropical Aracaee collection. Rock gardens consist of montain and alpine plants. The Hungarian Flora is represented by more than 600 species. The Füvészkert has about 300 Hungarian protected and the same number of red listed species from around the world to introduce the public, use for education. Some of these species are replanted to the natural habitat to strengthen their natural population with collaboration the competent natural parks (e. g. *Crepis pannonica*). The arboretum of the Botanical Garden is a unique value with its roughly 3,000 tree (e. g. *Ginkgo* variants) and shrub (e. g. *Lagerstroemia* variants) species and variants, in spite of its relative small size. The ELTE Füvészkert has 40,000 visitors per year. The website, the virtual trip and mobile application help to guide the visitors. Several professional events (e. g. Sakura, Ginkgo, Fig, Tomato, Tropical fruit) introduce the plants and the gardening and educate the inhabitants. We establish a green school to educate the children, like the Grüne Schule in Palmengarten der Stadt Frankfurt am Main.

Collections of Hungarian-bred ornamental woody plants in the Buda Arboretum

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The Buda Arboretum was founded in 1893-94 as a study-garden of the Hungarian Royal Horticultural School (the predecessor of the present Faculty of Horticulture), on 3 hectares, with 1000 taxa. Now it covers 7,5 hectares in the heart of Budapest, on the southern slope of the 235 m high Gellért hill. Nowadays the garden is embedded in the green space system of Budapest. The Arboretum is under very strong urban effect: the summer is hot, the winter is milder, the air is polluted, the soil is very limy. The plant material includes now over 1900 woody species and cultivars.

One of the main tasks of the Arboretum is the display and testing of Hungarian-bred woody ornamentals. These cultivars are bred to tolerate the extreme dry climate and unfavorable soil. Selection of stress-tolerant ornamental plants started in Hungary in the 1950s with the leadership of dr. János Domokos on the Department of Floriculture and Dendrology. The first phase of this work resulted in 8 selections of *Sorbus*, 3 *Tilia,* and among others *Fraxinus, Cornus, Juniperus* and other clone collections. From the 1980s we concentrated on the urban and industrial areas, they are most exposed to stress disorders, so except the native vegetation we expanded the research with non-native taxa. After the change of regime in 1989/90, several private nurseries also began to do selecting work independently, for example in the Prenor-, Alsótekeres- and Ifju Nursery, in addition the following persons: E. Barabits senior, E. Barabits junior, M. Bényei-Himmer, J. Domokos, Gy. Folly, Z. Ifju, E. Jámbor-Benczúr, M. Józsa, M. Kiss, L. Komiszár, G. Kósa, L. Lakatos, Gy. Magyar, G. Márk, L. Maráczi, J. Mészáros, B. Nagy, Zs. Nagy, J. Németh, L. Orlóci, J. Retkes, G. Schmidt, P. Szíjártó, E. Sipos, Ferencné Tóth, Gy. Tóth, I. Tóth.
At present, the arboretum has a significant collection of Hungarian cultivars, the latest and (probably) most perspective cultivars: *Prunus laurocerasus* 'Antonius', *P. l.* 'Cippora', *P. l.* 'Gabi', *P. l.* 'Hagar', *P. l.* 'Kleopatra', *P. l.* 'Miki', *P. l.* 'Leander', *P. l.* 'Manó', *Prunus padus* `Auróra`, *Sorbus borosiana* 'Alba Regia', *S. decipientiformis* 'Vallus', *Tilia platyphyllos* 'Pannonia', *Thuja (Platycladus) orientalis* 'Bence', *T. o.* 'Dundi', *T. o.* 'Hunor', *T. o.* 'Telihold'.
Key words: Hungarian woody ornamentals, cultivars, breeding, testing, Arboretum

Ex-situ conservation of the giant plantain (*Plantago maxima* Juss.) in Soroksár Botanical Garden
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The giant plantain is a highly endangered species of the Hungarian flora with a few populations threatened of extinction. Therefore, the ex-situ conservation is of great importance.
In our study we proposed to get to know the plants' environmental determinants for seed germination for a successfull propagation. Also our goal is to get acquainted with the habitat requirements of the species for estabilishing a new back-up population. In 2014 seeds were collected from six ripened spikes of six different plants. We investigated the effect of cold treatment as a factor responsible for breaking the seed dormancy and the light demand for the induction of seed germination. In addition, we compared the seed germination between the different mother plants and the germination rate between the different sized seeds originating from the same plants. We managed to grow a significant amount of plants, which were the initial bases of the ex-situ populations in Soroksár Botanical Garden. Three experimental populations were relocated to the natural meadows of the garden into different habitats. We measured the development of the plants in every two weeks.
Our results showed that cold treatment is not needed for the initiation of the germination. However, the seeds are positive photoblastic. We detected significant differences of seed germination between the mother plants but according to the size of the seeds we could not detect any differences. Comparing the three habitats showed that the mesofilous habitat differed from the other two in leaf size. In the number of leaves no difference were found between the three habitats.
In 2017 we will continue the measurements and also do some coenological surveys for more complex results also in the natural habitats, so that we can compare them to trace out the optimal habitat for the new back-up population in its natural land, close to the threatened original populations.
Keyvords: *Plantago maxima*, ex-situ conservation, germination

Population size estimation of three wild orchid species in the Botanical Garden of Soroksár
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The Botanical Garden of Soroksár is an exceptional one among the other Hungarian collections. Large expanse of natural and seminatural habitats can be found within the borders of the 60-hectar garden. The most valuable part of these is the approximately 12-hectar area of *Molinia* meadows which ensures home for numerous rare and endangered species. The Orchidaceae family recently represented by four protected species in these meadows. Three of them have large populations along the habitat. As a part of the survey of the conservation values of the botanical garden we made an estimation of population size of *Anacamptis palustris*, *Gymnadaenia conopsea* and *Dactylorhiza incarnata*. In 2016 the flowering individuals were counted on the whole area of the *Molinia* meadows. The number of the not flowering plants was estimated on the base of three 5m×5m sized sampling plots of each species. In these plots all of the individuals were counted and the ratio of the flowering and non-flowering individuals was calculated. The constancy of the flowering – non-flowering ratio was statistically acceptable only in the case of *Anacamptis palustris*. The numbers of the other

two species could be estimated with larger errors. We estimated 1240 individuals of *Anacamptis palustris* (1114 flowering), approx. 1460 individuals of *Dactylorhiza incarnata* (520 flowering) and approx. 4350 individuals of *Gymnadaenia conopsea* (2120 flowering). Due to the well known fluctuations in the flowering behavior of wild orchids and their tendency for dormancy our study should be evaluated as a first attempt for determining the size of these populations. However this survey could be the basis for the monitoring of our orchid species in the future and other research on their population dynamics.
Keywords: wild orchides, population size

Ecological factors affecting demographic parameters of *Cypripedium calceolus* in Latvia
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Orchids are very sensitive to habitat changes. *Cypripedium calceolus* is affected by a combination of several ecological factors. In Latvia, this orchid occurs mainly in partially shaded coniferous and mixed woodland on moderately moist soils, in wooded meadows and in forest clearings. It is sensitive to sudden changes in light conditions, which affects not only the size of the population, but also plant development. In this study we determined the effect of light as tree stand canopy openness (%) and vegetation (vascular plant and moss) cover (%) on *Cypripedium calceolus* demographic parameters (number of ramets, flowering number of ramets, number of flowers and seedpods per ramet). Data were collected in 2016 and 2017 from May to September in 12 populations in Latvia. Circular (1.5 m radius) sample plots with *Cypripedium calceolus* and without orchid (control sample plots) were used to collect data on cover in height classes of shrub and herbaceous species, and also cover of moss. The number of sample plots in each population varied, depending on the size of the population. Tree stand canopy openness was estimated from hemispherical images obtained using a digital camera with a fish-eye lens. Hemispherical images were analysed using the WinSCANOPY program. Poisson regression models were used to determine the effect of ecological factors on orchid demographic parameters.
Initial results showed that tree stand canopy openness (%) and cover of moss (%) had significant positive effect on number of ramets and number of flowering ramets. Understory and shrub cover less than 1 m height had significant negative effect on the number of ramets, number of flowering ramets and ramets with two flowers, but other ecological factors lacked significant effect on demographic parameters of *Cypripedium calceolus* in Latvia.
Keywords: *Cypripedium calceolus*, demography, lighting, vegetation cover.

Testing of herbal perennials to invasiveness
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During the direct introduction of plant material in botanical gardens, nurseries, it is possible that different types of cultivated plants may escape into and naturalize in local habitats. To prevent this, the objective of the study is to develop methods and test them for currently invasive herbal species identification and for predicting potential risk of invasiveness of new alien taxa. This will help to do corresponding actions in the future and control or limit the risk of invasiveness at regional and national levels.
The collection of ornamental herbal perennials of the Botanical Garden of the University of Latvia (BGUL) was studied. In the territory of BGUL the phenological, self-sowing and vegetative distribution data of 537 introduced alien taxa were collected for 21 years.
For the study, the group of 48 taxa with very good signs of adaptiveness was selected. All of them had high seed production capacity and showed possibility to invade their surroundings within artificial and seminatural plant communities. Of these, 11 have already been recognized as „garden escapers", and one of them - *Lathyrus latifolia* - in 2016 was found in the natural habitat of Latvia.
The other group for the study consisted of 254 taxa with good acclimatization: only 7 of them-possessed good self-sowing in seminatural communities (*Allium cernuum, Arabis caucasica, Aruncus dioicus, Dianthus barbatus, Primula elatior, Telekia speciosa, Verbascum olympicum*) and 35 of them exhibited intense vegetative expansion. 6 taxa had already been known as garden escapers in Latvia: *Fallopia sachalinensis, Fallopia japonica, Physalis alkekengi* var. *franchetii, Tulipa sylvestris, Vinca minor*.
It is concluded that 73 taxa from the BGUL herbal perennial plant collection have a potential to become invasive.
Key words: adaptation, invasiveness, herbal perennials, self-sowing

Magnolia collection in the Botanical Garden of the University of Latvia

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Magnolia is one of the most ancient woody plants; today, the genus is represented by approximately 300 species. Species are distributed in South and East Asia and in South and North America. Most of them are tropical and subtropical plants. The Global Tree Assessment's latest Red List publication highlights that nearly half of the magnolia species are threatened with extinction in the wild and different conservation activities are on the agenda. *Ex situ* conservation by the botanical gardens is a part of the Global Strategy for Plant Conservation.

Latvia is located on the north-east coast of Baltic Sea. Generally the climate of Northern Europe with cold winters is too hard for most *Magnolia* taxa. However, the deciduous magnolias which originate in the mountain region, can be appropriate for introduction in Latvia. The experience with the introduction of magnolias in Latvia started in Riga – in the Botanical Garden of the University of Latvia (BGUL) more than 60 years ago. Currently 17 taxa are in the collection 10 of them are species, three are hybrids and four are cultivars. Of the IUCN (International Union for Conservation of Nature) Red List of Globally Threatened Magnoliaceae, 3 species are present in the in BGUL collection: *Magnolia cylindrica* as vulnerable, *Magnolia stellata* as endangered, and *Magnolia wilsonii* as near threatened species. The age of the plants among threatened species is from 13 to 37 years; all of them are blossoming and ripening seeds.

Since the middle of the 20th century BGUL has tried to introduce around 60 species and sorts of magnolia. The natural habitats of tested taxa chosen for introduction are native to North America, China and Japan, where the climate is comparatively similar to Latvia. The magnolia species were grown from seeds obtained from other botanical gardens in China, Japan, Germany, Poland, The Netherlands and the Ukraine, but cuttings and plants of cultivars are from Germany, the Netherlands and the Ukraine.

Keywords: *Magnolia,* ex situ conservation.

Investigations of pollinators of ericaceous species in Lithuania

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Pollinator declines could affect many basic ecosystem services, food security and nutrition, agriculture and wild plant availability. One consequence of pollinator decline may be an increased vulnerability of some plant species to extinction. We focused on three ericaceous subshrub species: *Calluna vulgaris* L. (common heather), *Vaccinium myrtillus* L. (blueberry, bilberry) and *V. vitis-idaea* L. (lingonberry). Apart from the biological and ecological importance, they provide significant socioeconomic services, in the case of *Vaccinium* spp. All three species are entomophilous, pollinated by bees and other insects, and can be characterized by generalist pollination systems. Our study plants exhibit mixed-mating systems, but in all three species insect pollination is important for seed production, and both *V. myrtillus* and *V. vitis-idaea* may be pollen limited and can produce fruit of inferior quality if self-pollinated. The dates of field observations coincided with the peak flowering period of our study plants and observations took place in May for *Vaccinium* species and in August for *C. vulgaris*. Our investigations revealed that flowers of *V. myrtillus* were visited mostly by hymenopterans: social bees (*Bombus terrestris*, *B. pratorum*, *B. pascuroum*, *B. hypnorum*), solitary bees (*Andrena* sp., *Andrena* cf. *jacobi*), ants, and wasps (Vespidae), and also by dipterans (hoverflies Syrphidae); however, most of video-recorded visits (over 95%) were by ants (Formicidae), which fed on nectar. They visited flowers of *V. myrtillus* and *C. vulgaris* utilizing the nectar of both species and were the most abundant visitors to flowers of blueberry, suggesting that they may contribute to pollination, at least in *V. myrtillus*. The investigations were funded by a grant (No. SIT-1/2015) from the Research Council of Lithuania (MEKODINA).

Keywords: ecosystem, flower, pollinator.

In situ and ex situ conservation of gypsophilous plant community from the south-eastern part of the Sălaj County, Romania

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The gypsum habitats, due to their particularity, belong to the most threatened habitas in Europe, but they don't receive enough attention yet. Although gypsum soils are considered extremely unfavorable for life, the plant communities encountered here are remarkable and diversified.

The Gypsum from Sfăraj-Jebucu, situated in the south-eastern part of the Sălaj County a very interesting plant community. Our research the past few years has resulted in a record of 293 plant species belonging to 46 families. The area represents a refugium for Carpathian and Transylvanian endemic species (*Thymus comosus, Sesleria heufleriana, Jurinea transylvanica, Cephalaria radiata, Onosma pseudoarenaria*) in addition to rare

species encountered in Romania including *Gypsophila collina*, *Daphne cneorum*, *Artemisia alba*, *Salvia nutans*, *Plantago argentea*, *Echinops ritro* subsp. *ruthenicus*, *Astragalus monspessulanus* and *Seseli gracile*. The environment is considered only slightly affected by anthropogenic activities, and for the specific requirements of plant life and the survival of the species and their composition it is of great importance to preserve the quality and integrity of this habitat. Our attention focuses on more or less 50 taxa which are adapted to calcareous and gypsum substrate.

To save the richness and the peculiarity of the vascular flora native to the gypsum sediment of Sfăraș-Jebucu, we pronounced a proposal to conserve site as a protected area.

Over the past few years The Botanical Garden Jibou initiated an *ex situ* conservation program for 50 species of interest. For this purpose an area of about 100 m^2 in the garden was separated, and prepared with a special gypsum substrate resembling the natural habitat of Sfăraj-Jebucu. So far, 24 species are included in this unique planting of the Botanical Garden; these plants were obtained from seeds collected in the field at Sfăraș-Jebucu.

Keywords: conservation program, gypsum habitat, Botanical Garden Jibou

Interpreting the nature for its visitors - Informal education in the Botanic Garden "D. Brandza", University of Bucharest

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It is generally accepted that the majority of visitors entering botanic gardens go there to relax and enjoy the plants' beauty. However, the botanic gardens do not only offer their environment for relaxation, they also play an increasingly important role in educating people about how to protect nature and keep the environment healthy. To properly assume their role in education, botanic gardens have to share the secrets of the plant world in unique ways, i.e., using the strength of their collections and beyond. Traditionally, this is done through formal education initiatives, such as seminars, workshops, conferences, panels and producing informative materials; it can also be conducted informally, through new original ways that help to discover the natural phenomena and to bring them closer to people. Nature can be interpreted from several points of view: scientific, aesthetic, cultural, ethical, etc., and shown as a most important resourse that needs to be preserved. In the Botanic Garden „D. Brandza" all these aspects are transmitted through activities that combine plastic arts, photography, theatre, game, visitors experiences, encouraging them to re-evaluate their attitude and alter their future actions towards the environment. Therefore, among the most important activities that we organise are: plastic art exhibitions, with the main theme being the vegetal world transposed with colours on different supports (e.g. PLANT ART, Solar Exhibition, The Centenary Flowers); floral art exhibitions; photography exhibitions (e.g. Romania's Wild orchids, Healers in the world of plants); fruit and seeds exhibitions; creation of an original colour book, especially for adults, representing images of medicinal and ornamental plants; creative workshops.

Key words: ecological education, botanic garden, exhibitions, arts

Ornamental woody plants of Abkhazia, flowering in autumn, winter and early spring

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The article presents an overview of the types of ornamental plants blossoming in the period of autumn, winter and early spring. A total of 74 taxa are mentioned, indicating their life forms and flowering time. Plants are recommended for use in different types of plantings.

The study of the collection of living plant species of one of the oldest botanical gardens in Eastern Europe of the Institute of Botany of Abkhazian Academy of Sciences has great fundamental and practical significance. Among these, here we focus on plant species and forms that deserve special attention in the subtropical zone of Abkhazia, flowering in the autumn, winter, and early spring. More than 100 such species and cultivars are cultivated at the Black Sea coast. Of these, we studied 76 species and forms. Among them are introduced woody plants from different bioclimatic regions of the world, as well as 8 species native to Abkhazia: *Alnus barbata* C.A. Mey.; *Arbutus andrachne* L.; *Cornus mas* L.; *Corylus avellana* L.; *Erica arborea* L.; *Hedera caucasigena* Pojark.; *Hedera colchica* K. Koch; *Hedera helix* L. The time and duration of flowering of the woody plants are the most important indicators of their ornamental value. This depends on numerous factors, first of all, on the climatic features of the region, on the age and vitality of the plants, as well as on the use of proper cultivation and care. This presentation provides an overview of the brief botanical characteristics of the selected woody plants, discusses their structural features and ecological requirements, flowering times, ornamental qualities, and methods of reproduction. We also assess their cultivation and use in certain compositional solutions for landscaping.

Keywords: woody plants, flowering periods

Managing botanical illustration course in the Main Botanical Garden (Moscow, Russia)

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The Main Botanical Garden (MBG) in Moscow is the leading botanical garden in Russia. For many years it was mostly an academic organisation with a lot of closed doors for the visitors. Most of the information about collections and plants was confidential and only for staff. But the times had changed and we decided to make our botanical garden more friendly for visitors. When we came to work here at 2008 we noticed that there aren't any activities for the visitors in the Main botanical garden which could interest people in knowing more about plants or invite visitors to different departments such as Greenhouse, Arborethus et ctr. MBG still doesn't have an official social representation in Facebook, or in other social network. So we made an account for Greenhouse. And we decided to start with a Botanical illustration course with our classmate painter. We chose the Botanical illustration course as there such courses in our beloved botanical gardens such as KEW Gardens or Royal Botanical gardens in Edinburgh. As we couldn't get any additional financing from our administration we invited artists to work with us as volunteers. At the begging it was only one painter with more than 100k followers in Instagram. Now we have 4 of them and we start to pay them some money from the money we earn on the class. We made an announcement in Instagram and on Facebook page of our Greenhouse and in the Botanical garden. Now our classes are for people at age 12+, with any painting level. Earlier we tried to make classes especially for kids but there were 2-3 at a time and we decided to stop them for a change. The main idea of our class it that we teach is that you don't have to have special skills to draw a plant right away. We put emphasis on the illustration for botanical literature. The class is 2-3 hours long with 40 minutes lecture about plants that we'll draw. Mostly about its botanical features and what features will differ them from other plants. On our classes we usually draw living plants. Now we are working to make a real course of Botanical illustration containing 8-10 classes, which could complement each other, and so the student could draw a real botanical illustration in the end.

Keywords: botanical illustraition, botany

Fruit micromorphology in some Apiaceae of Eastern Europe

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While working on the taxonomy of Old World Umbelliferae, we made a collection of fruit SEM images for about 700 species. Here we present an analysis of species of the European part of Russia and some taxa of ajacent countries, a total of 140 species. We compiled a dictionary for the characters and character states for the umbelliferous fruits and made comparable descriptions. SEM images give us an opportunity to interpret our observations with an optic stereomicroscope and find new data for plant identification and taxonomic work.

The most complex micromorphology is inherent in zoochoric fruits. *Turgenia*, *Daucus*, some species of *Torilis* have anchor-like glochoidia, in *Turgenia* and *Torilis* glochodia are armed by numerous small hooks, in *Daucus* and *Caucalis* glochidia are smooth. *Torilis japonica, Caucalis, Otlaya, Sanicula* have hooked emergences. The species with secondary ribs bear straight thick-walled hairs with tuberculate or rugulose surface on privary ribs. Some species have pubescent fruits with simple unicellular hairs. The hairs in species of *Anthriscus* and *Heacleum* have milticellular bases. In *Pimpinella* and *Trinia* the hairs are solitary, while *Seseli* and *Ferula karelinii* have tufted hairs. The latter species has densely pubescent ovary; however, the fruit stretches to 10-15 mm long and 7-8 mm broad and the pubescence becomes sparse.

Cell borders are often inconspicuous. If visible, cells are arranged in rows or at random, cell borders are raised or sunken and always straight in species under discussion. Outer periclinal walls are concave, flat, convex domed, with small papillae, with sharp or blunt projection. Conspicuous, solid, convex exocarp cells are present in some genera: *Ostericum, Pleurospermum, Aulacospermum* and *Taeniopetalum.* These cells are distinguishable as shiny granulate surface in optical stereomicroscope. Cuticular foldings often correlate with wall shape: flat or concave walls are striate, convex walls are rugulate, sharp projections are striato-knotted.

Epicuticular secretions ("wax") are often absent and cuticular sculpture is clearly visible. Wax layer sometimes masks cuticula. In many *Bupleurum* species wax has the form of tiny scales.

Several species have glabrous fruits, inconspicuous cell borders and poor cuticular foldings, in this case there are no diagnostic micromorphological traits.

Key words: Umbelliferae, taxonomy, identification, fruit morphology

The development of electronic carpological atlas for Russian Umbelliferae in Botanical Garden of Moscow University

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In the Botanical garden of the Lomonosov Moscow University the Sector of Plant Taxonomy and Geography led by prof. M.G. Pimenov has investigated the family Umbelliferae (Apiaceae) for more than four decades. We published many taxonomic revisions of various genera and some regional treatments of the Carrot family, including “Umbelliferae of Russia”. In addition to special publication we developed materials for a broad range of users – students and naturalists. Umbelliferae is a difficult group for identification. We have published an illustrated computer key for plant determination (Umbelliferae of Russia, 288 species).

The fruits of Umbelliferae are diverse and their characteristics are of great value for taxonomy of Umbelliferae. The carpological characteristics are important for the delimitation of genera. Our team currently works on an electronic carpological atlas of Russian Umbelliferae, that will be loaded up to the WWW in 2017. We established a set of standardized characters and character states that have taxonomic value in the family. For every species a detailed description of morphology (23 traits), anatomy (15 traits) and micromorphology (11 traits) will be provided. We collected plenty of illustrations, most of them are original: colour macrophotos of fruits made with optical stereomicroscope, schemes of transversal sections of mericarps with anatomical details, coloured microphotographs of transections, and SEM photos of fruit surface.

The atlas is constructed as web-pages, it can be used off-line on personal computers and even on smartphones, and the on-line version will be periodically updated.

We also developed the database and multi-entry electronic key for identification of genera and the species of Umbelliferae of Russia on carpological characteristics. The key was produced on the JAVA platform as executable jar and is compatible with a broad list of operational systems. For identification, you can use any set of characters, depending on their presence on the material and on available instruments.

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Keywords: Apiaceae, carpology, morphology, anatomy

Succulent plants collections of A.V. Fomin Botanical Garden – Conservational and educational activities

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The A.V. Fomin Botanical Garden was founded in 1839. For more than 175 years of history, the garden has dendrological, herbaceous, tropical and subtropical plant collections, holding about 9,000 taxa. The succulent plant collection, the largest in Ukraine, has more than 2700 taxa that belong to 306 genera and 38 families. In 2015 the collection received the status of “National Heritage Collection of Ukraine”.

The main task building the collection was to present the amazing diversity of morphological structures marking the adaptation of plants to arid conditions. Other tasks included to show succulents native to different continents, as well as plants that are used in horticulture. In addition to the typical succulents from the families of Cactaceae, Crassulaceae, Apocynaceae, Aizoaceae, Aloaceae, other plants in Burseraceae, Cucurbitaceae, Vitaceae, Didiereaceae, Moraceae, and Moringaceae are also represented in the collection. The plants are either placed on shelves or planted out in the greenhouse.

Analysis of the IUCN Red List of Threatened Species showed that the collection contains more than 500 rare species from 13 families, while our list of CITES species has 1120 taxa from 14 families. The greatest number of rare IUCN red list species belongs to the family Cactaceae, and our CITES-listed taxa to Cactaceae and Euphorbiaceae. About 80% of our succulents entered their generative period of life cycle.

Based on our rich collection, classes are held for students, with a wide range of subjects from the field of ecology and botany. Studies and observations are made and materials collected for the qualification works of bachelors and masters of biological specialties and training practices of students. Tour guides conduct specialized excursions for the general public, especially for schoolchildren, most of whom visit the greenhouses during the flowering period of plants of the Cactaceae family. Employees are in close contact with fans of succulents, who often come to the garden, and exhibit their plants at thematic exhibitions in Kiev.

Keywords: succulent, collections, *ex situ* conservation, education

In vitro screening of antibacterial activities of various *Ficus* species cultivated under glasshouse conditions at Botanical Gardens of Ukraine

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The prospects of use of medicinal plants and plant-derived natural products for the treatment of bacterial diseases are at present actively studied. In order to contribute to this issue, the mega-diverse genus *Ficus* (Moraceae), one of the most species-rich and ecologically important plant genera, was chosen for evaluation of antimicrobial activity. Given that the antibiotic resistance has become a global concern, *in vitro* antibacterial assay of leaf extracts more than 70 species of *Ficus* genus, cultivated under glasshouse conditions, was the primary aim of this study.

The current investigations were undertaken in the frame of cooperation program between Institute of Biology and Environmental Protection, Pomeranian University in Slupsk (Poland) and two botanical gardens of Ukraine, directed to the assessment of medicinal properties of tropical species. The whole collections of tropical and subtropical plants at both botanical gardens have the status of a National Heritage Collections of Ukraine. Antimicrobial activities of crude ethanolic extracts of the plant samples were evaluated by the paper disc diffusion method.

Our results showed that ethanolic leaf extracts of *Ficus* species have potent antimicrobial properties against both Gram-positive (*Staphylococcus aureus*, methicillin-resistant *S. aureus* and *Streptococcus pneumoniae*) and Gram-negative bacterial strains (*Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, metallo-beta-lactamase producing *P. aeruginosa* and *Escherichia coli*), as well as against fungi (*Candida albicans, C. krusei)*. The results of our studies suggest that *Ficus* species are potentially rich in antimicrobial compounds and can be used in treating diseases caused by tested organisms.

Our findings provide a clear demonstration of the generally overlooked importance of collection of tropical plants accumulated in the botanical gardens as an important source of new chemical substances with potential therapeutic effects, including antimicrobial activity.

Keywords: *Ficus*, leaves, antimicrobial activity, disk diffusion method

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