1st ICHBG
BOTANICAL GARDENS WITH HISTORY

MUSEU NACIONAL DE HISTÓRIA NATURAL E DA CIÊNCIA, LISBOA | OCTOBER 11TH-12TH 2021

1st International Congress of Historical Botanic Gardens

Promoting and Protecting our Historical Legacy

Edited by

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International Association of Botanic Gardens (IABG) and University of Lisbon (UL), High School of Agronomy (ISA), Linking Landscape, Environment, Agriculture and Food R&D Unit (LEAF)

1st ICHBG

1st International Congress of Historic Botanical Gardens

Lisbon, Portugal, 11 - 12 October 2021

MUSEU NACIONAL DE HISTÓRIA NATURAL e DA CIÊNCIA

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1st International Congress of Historic Botanical Gardens

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TABLE OF CONTENTS

WELCOM

Over recent years, there has been a renewed interest in the care and value of historic botanical gardens – those with built heritage, historical collections, or historical connections. Such gardens have made a major contribution to our understanding of the origin and development of botanical science, and to related disciplines such as herbal medicine, ethnobotany and ethnopharmacology. They have also influenced many of the crops we grow, the food we eat and the trees, shrubs and herbs that adorn our streets, parks, and gardens.

However, unless prompt action is taken, many of these unique resources risk falling into neglect, decay or in some cases total loss. This is already happening in many places, and it is timely to celebrate and protect the treasures held in these historic botanic gardens. The 1st International Congress of Historic Botanical Gardens is held in Lisbon, 11-12 October 2021. In the second year of the great pandemic that conditioned our activity, we had meet in person, safely, or virtually, with the perks of those who may be present.

We dedicated this congress to Vernon Heywood, an intense and passionate life for Botany and Conservation of Biodiversity.

CONGRESS COMMITTEES

HONOUR COMMITTEE

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President of Instituto Superior de Agronomia (ISA), **Professor António Brito**

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European Botanic Gardens Consortium (EBGC), Eleni Maloupa

Red-CultIVA, Esteban Hernandez Bermejo

THE CONGRESS

The congress is the first of a series that the International Association of Botanic Gardens (IABG) pretend organize, which aims to strength the capacity and collaboration among historic botanical gardens all over the world as well as proposing targets and objectives for this type of gardens, that besides to be historical also are botanicals.

International Congresses of Historical Botanic Gardens will be organised every three years by the hosting institution with support from IABG, Botanic Gardens Conservation International and European Consortium of Botanical Gardens.

THE CONGRESS HOST - JARDIM BOTÂNICO DA AJUDA (JBA)

In 1755, most of the downtown area of the city of Lisbon was destroyed by a catastrophic earthquake and tidal wave. The king, D. José I, decided to move the royal residence to safer ground on the hillside of Ajuda. Refusing out of fear to live in any buildings made of stone, the king instead ordered the construction of a royal pavilion made entirely out of wood, which was completed in 1756. Once installed with his family, D. José ordered the construction of an adjoining botanical garden for the education and entertainment of his grandchildren, Prince José and Prince João (the future King João VI), sons of the king's daughter, D. Maria I.

To build the garden, D. José sent for Domingos Vandelli, a naturalist from Padua, who started work in 1764. The Real Jardim Botânico da Ajuda (Royal Botanic Gardens of Ajuda) was founded around 1768 and was the first botanical garden in Portugal, occupying an area of 3.8 hectares and composed of two south-facing terraces, forming a unique vantage point from which visitors can enjoy a magnificent view of the River Tagus. In the late 18th century, botanical missions to Portugal's overseas colonies greatly enriched the collection,

which at that time grew to around 5,000 specimens. During the French invasions of the early 19th century, many of the garden's botanical specimens were removed to Paris by order of General Junot. However, the garden survived, and through the professional care of Felix de Avelar Brotero managed to regain its prestige. In 1873, with the completion of another botanical garden at the Escola Politécnica, the botanical function of the Ajuda Garden came to an end. The garden passed to the administration of the royal palace and, once again, became a space of leisure for the Portuguese royal family.

With the establishment of the Portuguese Republic in 1910, the garden was renamed as the Jardim Botânico da Ajuda and placed under the care of the Instituto Superior de Agronomia (ISA), which performed a major renovation. The garden has been open to the public ever since, and in recent years has been used to support the ISA course in Landscape Architecture and other courses of Lisbon University.

At the end of the 20th century, the ISA applied successfully for European Commission funding to conserve the architectural heritage of the garden. The funding allowed for important restoration works: between 1994 and 1997, under the guidance of Professor Cristina Castel-Branco, the architectural and sculptural features of the two terraces were cleaned and restored, and the stone beds that house the botanical collection on the upper terrace were rebuilt according to drawings from 1869. The checkerboard-like pattern of 1,200 stone beds containing herbaceous and small shrubs is organised by phytogeographic area, according to the layout of the bicentennial trees already established in this area. At the same time, the cottage near the Calçada da Ajuda gate was restored and the Jardim de Aromas (scent garden) constructed. In a lively addition to the garden, the greenhouse near the Calçada do Galvão gate was converted into a restaurant, Estufa Real. Also on this occasion the Association of Ajuda Botanic Garden Friends was founded. This Association has an annual program of different kinds of courses related to nature and gardening, organizes cultural excursions all over the world to gain knowledge of the art and history of Gardens but also for observation of Nature, and it is responsible for the restoration works made to the JBA in the last years.

Despite the many challenges faced by the Jardim Botânico da Ajuda, most of the original vegetal elements remain to this day, especially its magnificent trees, which include a Dracaena draco, a Ficus microcarpa and a Ficus macrophylla, a Schotia afra and a Ocotea foetens. The live collection in open space has been rebuilt over the years and today numbers 1,602 taxa, all of them labelled. The collection of cactus and other xerophytic plants is also under development in another green house. In the Year of Biodiversity, 2010, a seed bank (Banco de Sementes Prof. João do Amaral Franco) was founded and since this date has contributed to the Millennium Seed Bank and store of Serra da Arrábida (a protected area) seeds, according to biodiversity conservation principles.

The Jardim Botânico da Ajuda is a space for everyone. Besides its educational and research functions, its airy terraces are the perfect place to go for a gentle stroll and take in the serene beauty of the River Tagus flowing below. It has a programme of guided tours for schools and the public and organizes very popular cultural events like the Spring Festival. For more information visit: www.isa.ulisboa.pt/jba

CONGRESS VENUE - NATIONAL MUSEUM OF NATURAL HISTORY AND SCIENCES

The MUHNAC / Museums of the University of Lisbon aims to promote curiosity and public understanding of nature and science, bringing the University closer to Society. This mission is achieved through the valorization of its collections and the university heritage, research, organization of exhibitions, conferences and other scientific, educational, cultural and leisure activities. The Museums are a Specialized Unit of the University of Lisbon, constituted by MUHNAC - National Museum of Natural History and Science in the area of Principe Real (Rua da Escola Politécnica), integrating the Lisbon Botanical Garden and the Astronomical Observatory of Lisbon (in Tapada da Ajuda, near the School of Agronomy).

The Museum supports research and teaching in the fields of zoology and anthropology, botany, mineralogy and geology, and other natural sciences and encourages the study and

dissemination of the history of science and technology, contributing to the scientific and cultural education of students in these fields.

The museum also assumes a responsibility extended to the national context, regarding the conservation and study of biological and geological collections and historical and scientific cultural heritage, establishing partnerships for the valorisation and use of museum collections and the heritage of Lisbon University and other institutions.

THEMES

Conference themes (***Promoting and protecting our historical legacy***):

1. Historic Botanic Gardens (case studies and definitions).

2. Botanic Gardens and the introduction of economically important species.

3. History is now – documenting and protecting contemporary gardens for posterity.

4. Managing Historic Botanic Gardens (problems and issues): Preserving the past while responding to contemporary needs.

5. Tourism opportunities for Historical Botanic Gardens.

Round Table: ***Promoting and protecting our historical legacy.***

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Promoting and Protecting our Historical Legacy

KEYNOTE ADDRESSES

WELCOME AND OPENING ADDRESS

MICHAEL KIEHN

Senior Vice-President, International Association of Botanical Gardens (IABG)
Director, Botanical Garden, University of Vienna, Austria

Dear friends and colleagues!

It is a great honour and pleasure for me to be invited to say some words during this opening ceremony of the FIRST International Conference of Historical Botanical Gardens.

I was asked to keep my address short – rather challenging, taking the scope, diversity and dimensions of the topic of this conference into account!

First of all, I personally as well as in my function as Vice-President of the International Association of Botanical Gardens (IABG), like to express my deeply felt thanks to the organizers and supporters of this important conference – please excuse my poor Portuguese pronunciation: “Muito obrigado por tudo”. Especially, muito obrigado para Dalila Espírito Santo, her team and her husband George – I can only vaguely imagine how much time, energy and enthusiasm you all have put into the project of this conference. And you have succeeded in making it happen in spite of the obstacles we all know too well.

I welcome all of you this morning – those who have managed to be here (by the way, I recommend to take some time to explore and enjoy our marvellous host city), and those who, I know, would have loved to be here but now, at least, can follow the conference from abroad.

For the next two days, the conference will deal with many important and relevant topics related to Historical Botanical Gardens, linking them to each other and to thoughts, visions and strategies for the future. I went through the program and look forward to hear many interesting and inspiring presentations. I expect fruitful discussions, and I am convinced that all this will trigger so much motivation and so many new topics that a follow-up, a second Conference of Historical Botanical Gardens will be a demand already for the near future.

I am sure that this conference will be a great success and will enhance collaboration and knowledge transfer between Historical Botanical Gardens and their staff as well as with relevant stakeholders outside the Historical Gardens community.

On behalf of the organizers and the International Association of Botanical Gardens it is a great privilege for me to now declare this Conference officially as opened.

OPENING CONFERENCE

The International Association of Botanic Gardens (IABG) and some thoughts on managing historical botanic gardens

TIM ENTWISLE

Royal Botanic Gardens Victoria, Australia

ABSTRACT: The International Association of Botanic Gardens is an intergovernmental collective that has been representing and supporting botanic gardens around the world since 1954. It has several formal roles associated with the United Nations and the planning of the International Botanical Congresses. Over the last 67 years it has managed a global list of botanic gardens and supported training workshops and conferences around the globe, much as it is doing on this occasion in Lisbon.

has promoted and supported the development of accreditation schemes for botanic gardens and is working presently on a certification to cover historic, cultural, landscape and horticultural aspects their business. A current review of its governance is likely to result in an 'association of associations' membership structure, and new opportunities to influence the establishment and promotion of botanic gardens worldwide.

I will also provide a few personal thoughts on the management of older botanic gardens, ending with an example from Royal Botanic Gardens Victoria. The White Oak project is a good case study for how to celebrate the life of a recently diseased fallen tree, while watching its climate-adapted replacements emerge. Mature, as well as young, botanic gardens must plan and plant for a climate challenged future.

International Association of Botanic Gardens representing and supporting botanic gardens globally since 1954

Member of:

- International Union of Biological Sciences (IUBS)
- International Association of Botanical and Mycological Societies (IUBMS; authority for the 6-yearly International Botanical Congress)
- International Council for Science (ICSU)

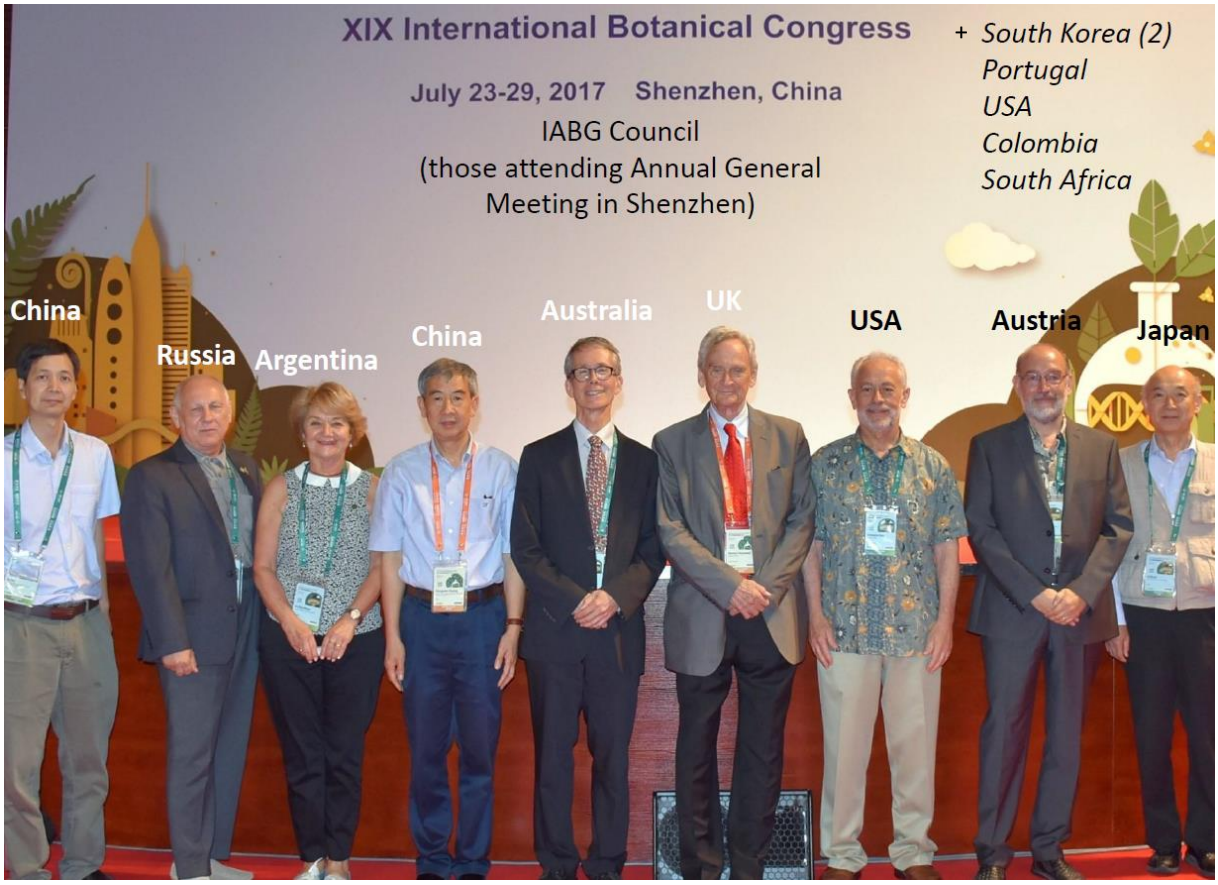
An intergovernmental association with formal links to United Nations organisations such as:

- Educational, Scientific and Cultural Organization (UNESCO)
- World Health Organisation (WHO)
- Food and Agriculture Organisation (FAO)
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

Professor Tim Entwisle
President IABG

Professor Hongwen Huang
Secretary General IABG

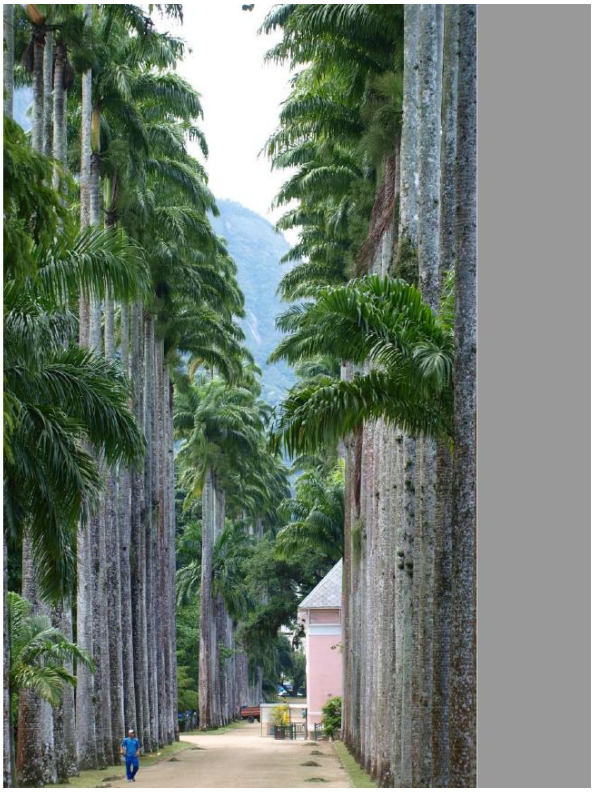
Professor Vernon Heywood
Immediate Past President IABG



What does IABG do?

IABG promotes the relevance and necessity of botanic gardens in civic life

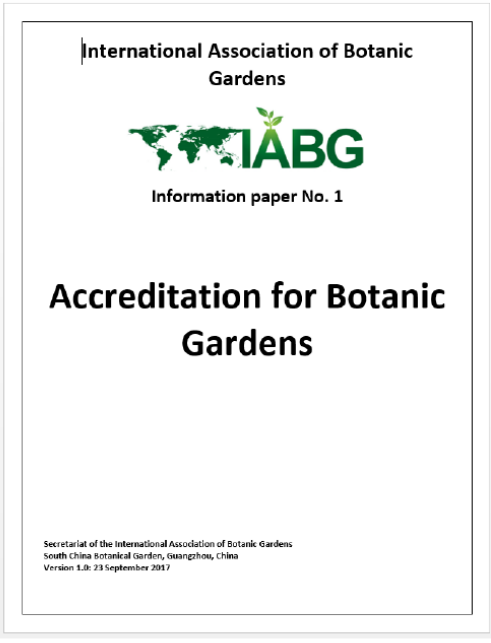
IABG advocates on behalf of all botanic gardens wherever they are situated and whatever their scope



IABG supports the establishment and development of new botanic gardens throughout the world

IABG maintains a **Global List of Botanic Gardens** and an **International Directory of Botanic Gardens**

IABG supports accreditation and certification of botanic gardens, such as the BGCI Accreditation Scheme



Certification Scheme for International Botanic Gardens Framework

Introduction

The stated aim of the Accreditation Scheme established by Botanic Gardens Conservation International is to "distinguish botanic gardens from non-botanic gardens and recognise achievements in plant conservation" (https://www.bgci.org/our-work/services-for-botanic-gardens/bgci-accreditation-scheme/). While the scheme assesses potential botanic gardens on criteria such as leadership, collections management, horticulture, public education, community/cultural activities, conservation actions, scientific research, staff, networking and sustainability, the primary focus at the Practitioner Accreditation and the Advanced Conservation Practitioner Accreditation levels are conservation activities.

The IABG has for sometime advocated for a more widely scoped accreditation or certification scheme for botanic gardens, recognising that some botanic gardens do not have a primary conservation focus or aspire to a broader scope of activities. In *Accreditation for Botanic Gardens* (IABG Information Paper No. 1, 23 September 2017; http://iabg.lubs.net/resourcecentre/papers/20180625_412881.html) existing schemes (priori to BGCI's) are reviewed and recommendations made for an IABG-led scheme.

Since that time the IABG Council has considered this matter further, particularly in light of the BGCI scheme, and decided that a Certification Scheme for International Botanic Gardens is needed to address a gap in the recognition and promotion of core botanic garden values.

The following scheme is proposed for review by the IABG Council.

Certification categories

Certification would be grated with the addition of relevant specialist categories, rather than any tiered system that might imply some gardens are 'better' botanic gardens because they hold more material or are better resourced.

Any botanic garden certified under this scheme is expected to hold a document, displayed and appropriately managed living collection.

The following categories are available:

- LC: Living Collection (documented, displayed and managed in accordance with relevant policies and legislation)

1

Certification categories

Certification would be grated with the addition of relevant specialist categories, rather than any tiered system that might imply some gardens are 'better' botanic gardens because they hold more material or are better resourced.

Any botanic garden certified under this scheme is expected to hold a document, displayed and appropriately managed living collection.

The following categories are available:

- LC: Living Collection (documented, displayed and managed in accordance with relevant policies and legislation)
- +E: Education
- +C: Conservation
- +B: Bioculture (human culture, ethnobotany etc.)
- +R: Research
- +H: History/heritage
- +L: Landscape attributes

We would also encourage a botanic garden to self-designate as either **Local**, **Regional** or **National**, to give a sense of scale (not based on budget or staffing, but on the focus for the botanic garden). While a designated local botanic garden might not typically be considered 'international' it still may meet the criteria to a sufficient level to be certified under this process.

So, for example, a regionally important botanic garden of historical value and with active research and conservation programs would be certified:

Regional LC+H+R+C

IABG encourages and supports regional botanic garden networks

English edition of Chinese Botanical Gardens

IABG contributes to meetings and conferences run by other societies, associations and organisations

Other benefits

- Provide peer support for the scientific and responsible management of botanic gardens, particularly regarding **climate change** and **invasive plants**
- Provide training and information to support all aspects of the business of botanic gardens including (but not limited to) science, education/learning, collections management, culture, horticulture, landscape design and maintenance, engagement, **history and heritage**, health and conservation.

Climate Change Declaration

Climate Change is happening now.

As a consequence, the issues our world faces are unprecedented and borderless.

The world's botanic gardens are custodians of critically needed scientific and horticultural knowledge, and their landscapes a source of inspiration, learning and a place for positive social change.

Our Climate Change Alliance will be the voice of committed botanic gardens from around the globe.

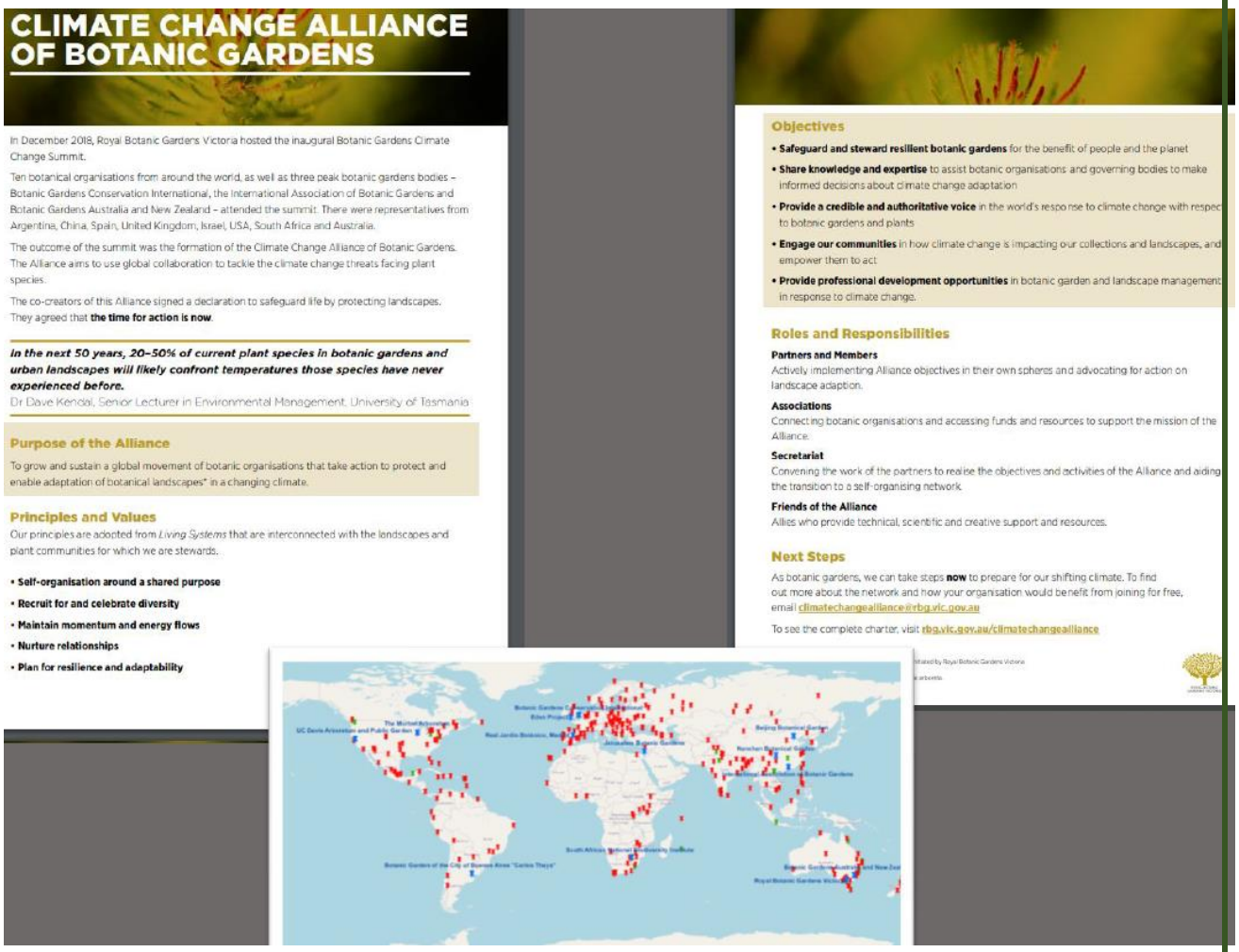
Together we will address the impacts of climate change on plants and landscapes, and increase our capacity to save lives and this planet.

Through this alliance, botanic gardens and like-minded organisations across the globe are uniting to safeguard our planet through resilient landscapes.

We, the gardeners of the world, say: "The time for action is NOW."

Late on the day of 6th December (2018) at Cranbourne Gardens, the 13 delegates attending our Climate Change Summit signed a declaration.

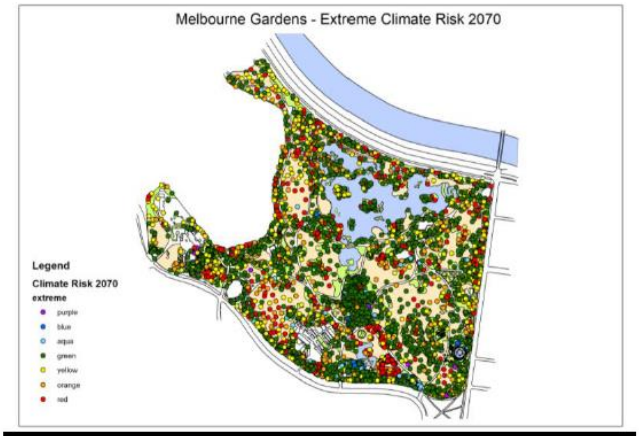
This powerful statement, and the eagerness of delegates to sign up to it, was a reflection of the feeling of optimism and determination in the room.



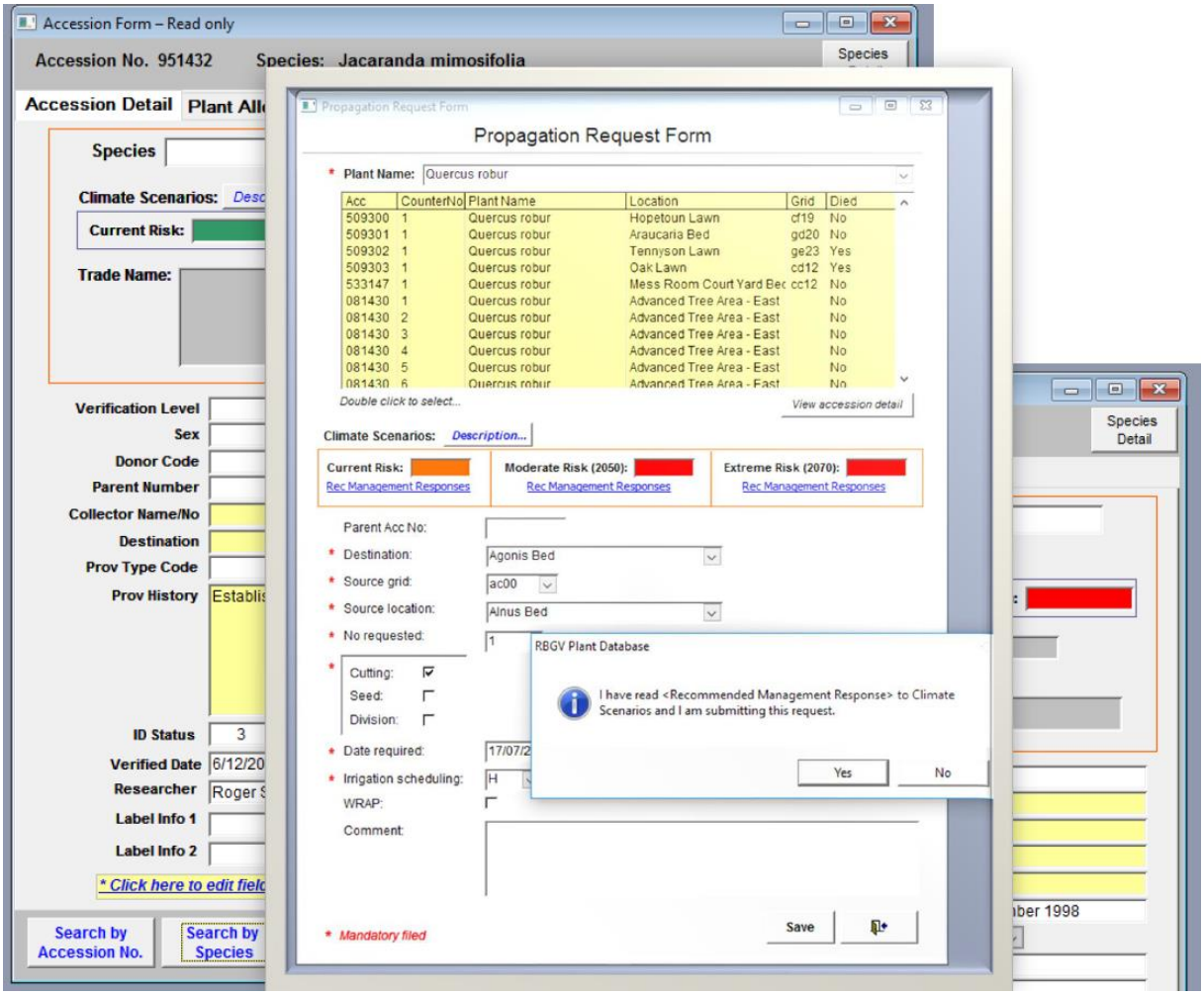
Climate Risk Assessment Tool

The Global Climate Risk Assessment Tool project is a world-first initiative to provide climate risk assessment data and decision support for taxa listings in PlantSearch for arboreta, botanic gardens and other users.

The Climate Change Alliance of Botanic Gardens is the project lead working closely with partners Botanic Gardens Conservation International, University of Tasmania, Royal Botanic Gardens Victoria and the **International Association of Botanic Gardens**.



Risk to trees within the Melbourne Gardens under the extreme climate scenario. Red circles indicate the species of highest risk from rising temperatures.



IABG What next?

- Reviewing membership structure and considering a shift to an **association of associations**
- Reviewing **membership list and website** with view to relaunching both under new membership structure
- Developing a **Certification Scheme for International Botanic Gardens**
- **Leveraging connections** with international organisations such as the International Union of Biological Sciences (IUBS)

Theme 1: HISTORIC BOTANIC GARDENS (CASE STUDIES AND DEFINITIONS)

HISTORIC BOTANIC GARDENS – PROVIDING SOLID FOUNDATIONS FOR A GLOBAL BOTANICAL COMMUNITY.

PETER S. WYSE JACKSON
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ABSTRACT: In this paper a summary and overview is provided on the development of botanic gardens worldwide from the earliest times. It outlines their historical roots and the ways in which their priorities, roles, influences and resources have changed over the centuries. The paper also plots the fundamental changes in the international biodiversity and environmental policies and concerns over the last thirty years and how this has had a profound impact on the numbers, activities and perspectives for botanic gardens everywhere.

It highlights how the first botanic gardens of the modern era were created in Europe, mainly associated with universities and often linked with medical teaching. It explores how these evolved to become important institutions in the development of botany, and influential in many parts of the world in the discovery of the plants and to support agricultural development, particularly in the tropical colonies of some European countries.

It summarizes how many European university botanic gardens evolved to become institutions for plant discovery, taxonomy and plant introduction, leaving the hugely important legacy of extensive living collections, herbaria and libraries.

It describes the roots of many historic botanic gardens in other regions of the world too, including Latin America, Africa, Australasia and North America and how many such botanic gardens, particularly in temperate regions, maintained a focus on horticulture rather than on research.

The paper points out how a remarkable number of botanic gardens that have been created worldwide over the last 40 years, with many new botanic gardens created in most regions of the world. The shifts in policies and practices among botanic gardens had been greatly influenced by the development of an

increasingly crowded international dimension in international policies, particularly in relation to biodiversity, sustainable development and, more recently, by climate change responses.

Important milestones for botanic gardens over the last 40 years are identified, including, amongst others, the establishment of Botanic Gardens Conservation International (1987), the publication of the Botanic Gardens Conservation Strategy (1989), the agreement of the Global Strategy for Plant Conservation (2002) and the U.N. Sustainable Development goals (2015). Some definitions of botanic gardens are considered and how these reflect changing roles and perspectives of botanic gardens.

The paper finishes with a call for more botanic gardens to respond to addressing the great global challenges we face in the future, learning from our past and developing priorities that align with the greatest needs to safeguard plants and nature over the coming century.

KEYWORDS: History and development of botanic gardens, Plant conservation, Biodiversity, Convention on Biological Diversity, Ex situ conservation, Global Strategy for Plant Conservation, Herbaria, Human health, Living collections, Sustainable development

INTRODUCTION

The earliest botanic gardens and their European origins

The first botanic gardens in the western world in the modern era were created in Europe, mainly associated with universities and particularly linked with medical teaching, growing, studying, and demonstrating a wide diversity of plant species used for medical purposes. Most notable was the foundation of the Botanic Garden of Pisa, Italy, in 1543 by Luca Ghini, who was also distinguished as having created the first recorded herbarium. The Pisa Garden was followed shortly afterwards by the establishment of botanic gardens in Florence (1545), Padua (1545) and Bologna (1547), all intended for the study of medicinal plants and the instruction of students at their respective universities (Bedini & Garbari, 1991).

Some suggest that the first botanic garden designer was Matteo Silvatico (1285-1342), who founded a physic garden at the Salerno Medical School in southern Italy in 1317 (Ferriolo, 1998). This garden was the first known to have had the herbs it contained arranged in a 'scientific' manner.

Many of the earliest European botanic gardens survive today as outstanding historical monuments, important sources of pride for their founding universities and cities. These include those in:

- Leipzig (1542), Germany;
- Zurich (1560), Switzerland;
- Leiden (1577), the Netherlands;
- Heidelberg (1593), Germany;
- Paris (1597) and Montpellier (1598), France;
- Oxford (1621), the U.K.;
- Uppsala (1655), Sweden;
- Edinburgh (1670), Scotland;
- Kiel (1669), Berlin (1679),
- Tubingen (1675), Germany;
- Amsterdam (1682), The Netherlands;
- Wurzburg (1696) and Halle (1698), Germany.

The dates given in brackets are their dates of foundation (Heywood et al., 1990). All these

institutions are operating today as botanic gardens (Wyse Jackson and Sutherland, 2017).

Matthaeo Silvatico teaching his students about medicinal plants in his physic garden in Salerno, from the frontispiece to a 1526 edition of *Opus Pandectarum Medicinae*

One of the best known such medicinal gardens which still bears a name associated with its medicinal plant origins, is the Chelsea Physic Garden in London, founded in 1673. In Ireland, at Trinity College Dublin, a physic garden was established in 1687, which became the first of a series of botanic gardens associated with the university and other institutions that continues to the present day (Wyse Jackson, 2010; Wyse Jackson, 1987). The development of botanic/physic gardens in so many European universities in the 1600s and 1700s was certainly stimulated by the connections between these academic institutions.

Elsewhere in Europe the 1700s saw the continued trend for the establishment of important university botanic gardens, including botanic gardens associated with universities in the following cities and countries:

- Gottingen (1736), Frankfurt (1763), Greifswald (1763), Stuttgart (1775) and Marburg (1789), Germany;
- Vienna (1754), Austria;
- Madrid (1755), Spain;
- Ajuda, Lisbon (1768) and Coimbra (1774), Portugal;
- Glasnevin, Dublin (1795), Ireland;
- and others.

The Padua Botanic Garden is the oldest surviving botanic garden, parts of which are laid out in the form similar to what was created in the 16th century. In 1997, it was the first botanic garden to be added to the World Heritage List for its "outstanding universal value" (Periti, 2016).

Throughout history, plants have been the most important source of medicine for human health. Medical use of plants by early European herbalists did not follow any system based on the chemical constituents of the plants. Instead, they used a system that came to be formalised in the 17th century as the 'doctrine of signatures', in which a particular plant shape or colour suggested a use for the plant in the treatment of a specific ailment. For example, yellow flowers were used to treat jaundice, a condition characterized by a yellowing of the skin and the eyes; plants with kidney-shaped leaves were used to treat renal (kidney) ailments, and so on. There are many examples of the ways in which particular plants were interpreted as containing 'cures' for certain ailments in the eyes, lungs, ears, kidneys etc. There was a belief that God had marked each plant with a 'clue' as to its usage and purpose. Such associations were often, then, the basis for

the use of a plant for a particular treatment, some of which proved to be effective. Displays of plants in an early botanic or 'physic' garden was therefore an ideal way to teach about the doctrine of signatures and plant usage.

Without a doubt, some plant uses were derived from widespread ancient European traditions, including Greek and Roman practices. We know that the Romans practiced gardening and spread the cultivation of plants in gardens for ornament and utility across Europe with the expansion of the Roman Empire in the 1st century A.D. (Hadfield, 1969). Theophrastus established a garden in Greece, in Athens in 340 B.C., which might perhaps be described as one of the earliest 'botanic gardens' in Europe. Theophrastus (372 B.C. - 288 B.C.), a student of Plato and Aristotle, established his garden in c.340 B.C. near the Lyceum in Athens, Greece. In his *works De causis plantarum* (The Causes of Plants) and *De historia plantarum* (The History of Plants) he identified c.500 plant species and varieties.

In the Middle Ages, European monasteries were important centers for learning, and were, in effect, the forerunners of what because Europe's universities. Many of these monasteries had gardens where medicinal plants, herbs and vegetables were cultivated, a legacy that was later developed in the form of the earliest physic gardens in Italy, France, the Netherlands and Britain. Even today one can find naturalized herb and medicinal species around early monastic sites in Ireland, remnants of the monastic gardens that once existed there (Wyse Jackson, 2014).

Early 'botanic' gardens around the world

Elsewhere in the world, such as in China, India and the Arab world, medicinal plant usage led to the development of very early gardens too, which perhaps could also be described as 'botanic gardens'. For example, in ancient Egypt there was an extensive tradition in using plants for medicinal purposes. Lists of plants dated to the 2nd millennium B.C. have been found in documents and inscriptions and there are drawings known preserved in Egyptian tombs of gardens that show different plant types and their uses (Periti, 2016). For example, the Temple of Amun-Re at Karnak includes a drawing of the flora and fauna of the garden of Thutmose III (Periti, 2016). Thutmose III was the sixth pharaoh of the Eighteenth Dynasty in Egypt and ruled for almost 54 years. His reign is usually dated from 28 April 1479 BC to 11 March 1425 B.C. (https://en.wikipedia.org/wiki/Thutmose_III - Accessed 14/02/2022).

Also, in China, for example, there were early gardens developed that originated as medicinal plant gardens. For example, according to a book written by Sima Qian in the Song Dynasty (420-479 A.D.) of China, there was a garden of medicinal plants named Du-Le, in which each plant was labelled (He & Cheng, 1991). These authors point out that herbalism led to the development of botany in China, suggesting that the tradition of botanic gardens, for the cultivation of medicinal plants, can be traced back from the present day almost two millennia. The oldest existing botanic garden in China is the Nanjing Botanic Garden Mem. Sun Yat-sen in Nanjing, Jiangsu Province, established in 1929 (Heywood et al., 1990). He and Cheng point out that the history of modern Chinese botanic gardens is relatively short, a for many little more than half a century, yet the collection and research of traditional medicinal plants have had a history of many thousands of years, with distant sources and a rich and marvelous cultural legacy. We still know too little about most of these gardens in various regions to be certain how much we should regard them as 'botanic gardens' in the modern sense or not. In homage to this Chinese garden tradition, the Margaret Grigg Nanjing Friendship Garden was

created in 1995 at the Missouri Botanical Garden which is modeled on the "scholar's gardens" of the southern provinces of China.

The Margaret Grigg Nanjing Friendship Garden at the Missouri Botanical Garden

Further gardens, that could perhaps be described as 'botanic' are known from pre-Columbian Mexico, such as the Chinampas, 'Floating Gardens' on Lake Tenochtitlan, in southern Mexico City, where can be found the famous canals of Xochimilco, the last remnants of a vast water transport system built by the Aztecs. The extensive early use of plants for herbal medicine in Mexico is documented in the Badianus Codex of 1552. The Badianus Manuscript, (Codex Barberini, Latin 241) is an Aztec Herbal dating to 1552 that was discovered at the Vatican Library in 1929. It is the oldest known work on Mexican medicinal plants and plant remedies. It is the work of two Aztecs, Martinus de la Cruz, a native physician and teacher of medicine who composed the work in Aztec, and another, Juannes Badianus, who translated the text into Latin (https://www.wrf.org/medicine-history/the-badianus-manuscript - Accessed 12/02/2022).

However, returning to Europe, the early university botanic gardens really did provide the basis for the development of botanic gardens as we know them today. And it is remarkable that many of the earliest such gardens still survive and are important historical monuments for their founding universities, cities and countries. These historic botanic gardens are an important part of the cultural, historical, scientific and architectural heritage of Europe and worthy of governmental and philanthropic support to conserve and preserve these unique places. For example, their historic landscapes, statuary, architecture and historic buildings that survive today in European botanic gardens, amongst many more, include Kew Palace (1631) at the Royal Botanic Gardens, Kew, United Kingdom; the Curvilinear Glasshouse designed by Richard Turner (1843–69) at the National Botanic Gardens, Glasnevin, in Dublin, Ireland; the Orangery of the University of Vienna Botanic Garden (1755), the 18th century King's Gate by Sabatini and the Villanueva Pavilion at the Royal Botanic Garden Madrid; and the Palm House (1872–74) of the University of Copenhagen Botanic Garden.

Evolving roles for historic botanic gardens

Over the years, university botanic gardens in Europe moved away from their focus of medicinals and evolved to become gardens for plant discovery, taxonomy and introduction – some of them combining roles as botanical museums as well as gardens. Today many of these earliest botanic gardens contain hugely important collections in their herbaria and historic botanical books and manuscript collections. Botanic garden herbaria worldwide today probably include more than 150 million specimens.

In Europe, while many botanic gardens expanded their collections and became centres

for the study of plant diversity, the focus of their research soon also moved away from the living collections themselves and concentrated increasingly on taxonomic studies in the herbaria that were founded in the institutions associated with the gardens. As a result, very often the living collections had little research undertaken in them. This identification of botanic gardens with taxonomy continues to the present day. This European model for a botanic garden was also applied in other parts of the world too.

Many botanic gardens were developed following the classic European multi-purpose model, open to the public and with extensive living plant collections, herbaria, libraries and major facilities for horticulture, such as a nursery and display and production greenhouses. Many had academic staff undertaking botanical research. Some were associated too with learned societies, such as what is now the National Botanic Gardens of Ireland, which was originally founded in Dublin in 1795 by the Royal Dublin Society.

In a book by John Prest (1988), 'The Garden of Eden: The Botanic Garden and the Recreation of Paradise', he suggests in his analysis of the development of European botanic gardens, that many of these botanic gardens were an attempt to recreate the Garden of Eden. Early explorers still hoped that they would find the original Garden of Eden somewhere in the world. Bringing back or sending back plants from their voyages enabled the creation of Gardens with plants from all around the world in what could be interpreted as a 'recreation of Eden'. However, the beginnings of European botanic gardens are certainly intrinsically linked to the beginnings of modern science in the Renaissance, with the collection of data, and observation and recording of structures, causes and effects.

The origins of early tropical botanic gardens

The development of early tropical botanic gardens was more motivated by considerations of trade and commerce than by science for its own sake. This was especially true of those that were established by the European colonial powers in their territories in the 18th and 19th centuries. The first botanic garden to be founded in the tropics was the Royal Botanic Gardens Pamplemousses in Mauritius, the Indian Ocean island that was home of the now extinct Dodo. That Garden was founded in 1729 (it is now the Sir Seewoosagur Ramgoolam Botanic Garden), initially to provide fresh fruit and vegetables for the settlement and for ships calling at the port. Many spice plants and cassava were introduced to feed enslaved people and later many more economically useful plants added (Rouillard & Guého, 1983).

The focus on economic plants was also the pattern for most of the botanic gardens created in India, South-East Asia and the Caribbean, mainly by the British and the Dutch. Many crop plants were introduced by or through these gardens - often in association with European botanic gardens such as Amsterdam and Kew - and included breadfruit, cinchona, cloves, cocoa, coffee, oil palm and rubber. The emphasis was very much on economic development. Several of these gardens were created specifically to act as nurseries or propagation centres for the receipt of germplasm of commercial crops from overseas. Notable amongst these were the Indian Botanic Garden, Howrah, Kolkata (Calcutta), founded in 1787; Royal Botanic Gardens at Peradeniya, Sri Lanka founded in 1821 and the Singapore Botanic Garden, founded in 1859 into which were brought the first introductions of Para rubber. At the Bogor Botanic Garden in Indonesia, founded in 1817, the first oil palm in South East Asia was introduced.

The movement of germplasm by these tropical botanic gardens across the continents was

largely responsible for helping to set the major agricultural patterns in the tropics in several parts of the world. Once these patterns were set, many of these tropical gardens declined in importance as their roles in agriculture, forestry and horticulture were moved to separate institutes or government departments. Nevertheless, many of these gardens retained major or new roles in research and the scientific study of tropical botany.

One more example is the St. Vincent Botanic Garden, in the Caribbean, the oldest botanic garden in the Americas, which was established in 1759 by British colonial leaders. It was created primarily to provide medicinal plants for the military and improve the life and economy of the colony. Today it still has a wide variety of economic plants and acts as an important source of fruit trees and ornamental plants for that country. There are even breadfruit trees there that are said to be descended from those introduced by Captain William Bligh in 1793 on his voyage from the Pacific, a second expedition following the ill-fated voyage of H.M.S. Bounty in 1789 (Wyse Jackson, 1991).

New botanic gardens in the 19th and 20th centuries

In many temperate regions a large number of civic or municipal botanic gardens were founded in the 19th and 20th centuries. In the 20th century, such gardens were a particular feature in the United States, Australia and New Zealand.

Notable early historic botanic gardens in Australia include the Royal Botanic Gardens Sydney, which was established in 1816 following the use of its site from the late 1780s as the first farm for the new British colony (Gilbert, 1986). Other early Australian botanic gardens are in Hobart (1818), Melbourne (1845), Adelaide (1855), Ballarat (1858), Brisbane (1855), Cooktown (1885), Cairns (1886) and Darwin (1886). In New Zealand, the major botanic gardens were established during the second half of the 19th century - Christchurch (1863), Dunedin (1863), Timaru (1864) and Wellington (1869), and the University of Auckland Botanic Garden was founded in 1883.

Many of these gardens did not initially develop major scientific facilities or programmes. There are notable exceptions to this, however, such as Missouri Botanical Garden in St Louis, U.S.A. It was founded in 1859 by an Englishman, Henry Shaw, on his estate in the city. The Garden has now one of the largest science programmes of any botanic garden worldwide and an herbarium with over 7.5 million specimens. Another exception is the Palmengarten in Frankfurt, Germany, founded in 1869 and which today has one of the world's leading orchid and succulent collections. Nevertheless, most of these civic botanic gardens did develop a strong horticultural aspect - they were botanic gardens in the sense of building up and maintaining collections of usually well-labelled plants, and exchanging seeds with other

botanic gardens throughout the world. Some though were "botanic" gardens only in name.

In tropical Africa and in Latin America the patterns of development and the part played by botanic gardens are quite different from those elsewhere. With very few exceptions most are twentieth century foundations. In South America, only Rio de Janeiro Botanic Garden dates from the 19th century (1808) and in Central America, an early botanic garden was founded in Mexico in 1781; otherwise, all other botanic gardens in Latin America are recent, many of them created in the last forty to fifty years.

The Spanish favoured the creation of acclimatisation gardens such as that of La Orotava in the Canary Islands on Tenerife. It was founded in 1788 to assist the introduction into Spain of many new species of plants being discovered in the Spanish territories in the Americas and Asia.

In Africa, the oldest garden is in Cape Town where the Dutch East India Company established a garden in 1652. Its creation was for the purpose of providing fresh vegetables to the settlement as well as to passing ships. However, it did become a way-station for many plants being sent back to Europe. South Africa's oldest existing botanic garden is in Durban, founded in 1849. It has a particularly notable collection of indigenous cycads. In tropical Africa most botanic gardens are relatively modern, apart from three founded before the end of the 19th century (Entebbe, Uganda (1898); Zomba, Malawi (1891); and Limbe, Cameroon (1891)).

The number and diversity of botanic gardens worldwide

The 'International Agenda for Botanic Gardens in Conservation', (Wyse Jackson & Sutherland, 2000), includes a classification of botanic gardens, categorizing them into 12 different types today, although many botanic gardens fit into several of these categories.

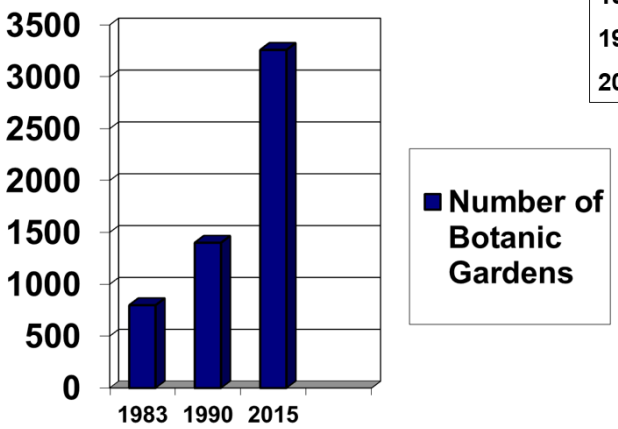
Table 1. The types of botanic gardens (from Wyse Jackson & Sutherland, 2000)

1 'Classic' multi-purpose gardens
2. Ornamental gardens
3. Historical gardens
4. Conservation gardens
5. University gardens
6. Combined botanical and zoological gardens
7. Agro-botanical and germplasm gardens
8. Alpine or mountain gardens
9. Natural or wild gardens
10. Horticultural gardens
11. Thematic gardens
12. Community gardens

While it is notable that the majority of the world's botanic gardens have been created in the last 50 to 70 years, it is also important to recognize that many of the most ancient botanic gardens are still thriving, and today many of them are world-leading botanic gardens.

The number of botanic gardens known worldwide continues to grow and it has been remarkable how many have been created worldwide over the last 40 years. The numbers included in Figure 1 below are derived from listings included in International Directories of Botanic Gardens published in 1983 (Henderson, 1983) and 1990 (Heywood et al., 1990) and BGCI's Garden Search database consulted in 2015.

Figure 1. Growth in the number of botanic gardens worldwide over 40 years.

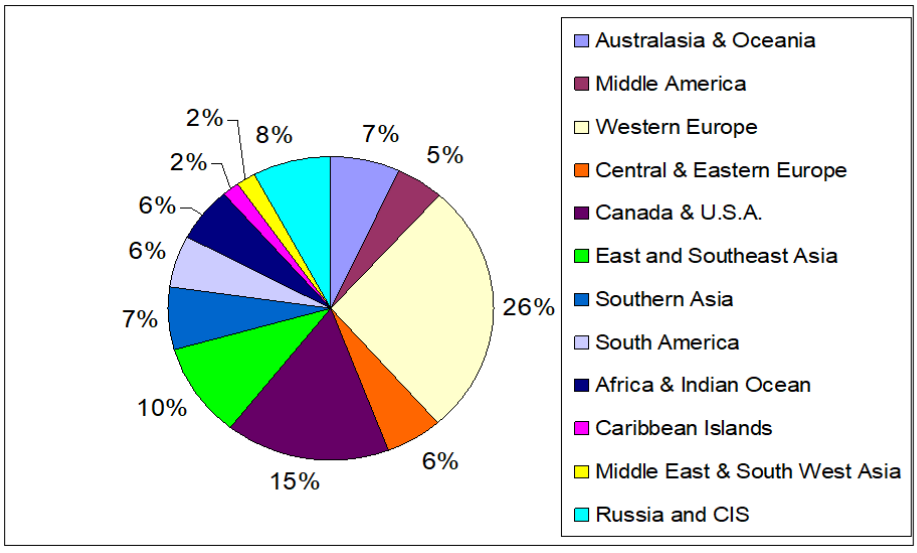


1983:	798
1990:	1,400
2015:	3,259

The many of newly established botanic gardens or redeveloped older botanic gardens are situated in developing countries or in the regions of high plant diversity. In the last forty to fifty years there has been a renaissance in botanic gardens worldwide, largely as a result of the rising concern for biodiversity loss and the need for many more institutions to become active in plant conservation. There has also been a corresponding rise in botanic garden involvement in education, research and conservation of the floras of their own regions or countries.

While the majority of botanic gardens occur in Europe and North America, it is notable that the numbers of new botanic gardens in regions such as in Latin America, East and Southeast Asia, including China. There is huge potential for the expansion and development of the network of botanic gardens worldwide.

Figure 2. Distribution of botanic gardens – percent by region



It is exciting to see new botanic gardens being created in countries where there were none previously. One such is the Royal Botanic Garden of Jordan, established in 2005, and created and led through the vision and determination of one individual, Her Royal Highness Princess Basma bint Ali. It is already playing important roles in Jordan in such areas as plant conservation and rangeland management,

ecological restoration and environmental education. It is developing the National Herbarium of Jordan too and has created a seed bank and living collection of native species. It was founded as a non-governmental, non-profit entity to conserve the native flora of Jordan. Its mission is to ensure native flora conservation through ecological restoration and providing research and demonstration sites to address the environmental challenges of our times (http://royalbotanicgarden.org/page/welcome-royal-botanic-garden-jordan). Many new botanic gardens worldwide have embraced similar missions, dedicated to environmental protection and plant conservation.

We should review too what we consider to be a botanic garden. Certainly our understanding of what is a botanic garden in the modern sense has developed and evolved. I found an old definition in a publication of the International Association of Botanic Gardens (IABG) from 1963, which defined a botanic garden as one "*which is open to the public and in which the plants are labelled*". A more recent definition that I proposed in 1999 says that they can be defined as "*an institution holding documented collections of living plants for the purposes of scientific research, conservation, display and education*" (Wyse Jackson, 1999).

In recent years a number of organisations have considered or developed botanic garden accreditation initiatives, including BGCI (BGCI 2021)., ArbNet (ArbNet 2022) and IABG, and these will certainly help in defining what are botanic gardens and stimulating more to reach high levels of operation.

It is worth looking briefly at what influences and actions have stimulated this remarkable growth in the botanic garden community worldwide over the last few decades. Clearly the establishment of Botanic Gardens Conservation International in 1987 has been hugely influential, helping to provide strategic direction, advice, guidance and support to many new and developing botanic gardens.

Opportunities for botanic garden professionals to meet very regularly throughout the world have been influential too, allowing them to share experiences, expertise and to consider future shared priorities. Table 2. shows the series of international botanic garden conferences and congresses held since 1985. There are many regional, national and thematic meetings as well which have helped to ensure that botanic gardens share many similar operating principles, policies, goals and strategies.

Table 2: BGCI Global Congresses

International Botanic Gardens Conservation Congresses

- 1st 1985: Las Palmas, Canary Islands
- (BGCI created 1987)
- 2nd 1989: Réunion Island, Indian Ocean
- 3rd 1992: Rio de Janeiro, Brazil
- 4th 1995: Perth, Western Australia
- 5th 1998: Capetown, South Africa

World / Global Botanic Gardens Congress

- 1st 2000: Asheville, North Carolina, U.S.A.
- 2nd 2004: Barcelona, Spain
- 3rd 2007: Wuhan, China
- 4th 2010: Glasnevin, Dublin, Ireland
- 5th 2013: Dunedin, New Zealand
- 6th 2017: Geneva, Switzerland
- 7th 2022: due to be held in Melbourne, Australia

An outcome of the conference held in 1985 in Gran Canaria was the Botanic Gardens Conservation Strategy, published in 1989 by IUCN, WWF and what was then the IUCN Botanic Gardens Conservation Secretariat. This provided the first global policy framework for botanic gardens' conservation actions against

which individual institutions could align their programmes and aspirations.

This was followed by an update in 2000, published as the International Agenda for Botanic Gardens in Conservation (Wyse Jackson & Sutherland, 2000). That was subsequently endorsed by over 500 botanic gardens and contained updated botanic garden priorities, taking into account the growing understanding of botanic garden roles, potentials and conservation priorities.

At the same time as the development of the International Agenda, work began to create the Global Strategy for Plant Conservation (GSPC), to have available an action agenda for plant conservation, for the first time, linked to the U.N. Convention on Biological Diversity (Blackmore et al., 1999). This was adopted by the Convention in 2002 and supported by every Party to the Convention. For the first time ever it incorporated time-bound global targets on what needed to be undertaken in biodiversity conservation. It was subsequently updated for the period up to 2020, and today we continue to negotiate how it will go forward after 2020.

Development of the Global Strategy for Plant Conservation (GSPC)

- Resolution of the XVI Botanical Congress (St Louis, 1999)
- Gran Canaria Declaration (2000)
- Adopted by the Convention on Biological Diversity (CBD) in 2002
- Updated for the period 2010-2020
- Post-2020 GSPC under development linked to CBD's Global Biodiversity Framework

Shortly after the adoption of the GSPC, a Global Partnership for Plant Conservation was created to support the worldwide implementation of the Strategy. It was launched at the CBD's 7th Conference of the Parties in February 2004 in Kuala Lumpur. It has played significant roles not only in implementing the GSPC but also as part of a flexible coordination mechanism adopted by the Convention to guide and monitor GSPC implementation. Today, more than half of the members of that partnership are botanic gardens.

Many botanic garden networks also responded to these concerns and initiatives at national and regional levels, preparing a wide range of national botanic garden strategies and action plans.

The growing international dimension in biodiversity conservation policy at all levels has also been hugely influential. Before 1992, there were relatively few international treaties and conventions, other than CITES, the Ramsar Convention and the World Heritage Convention (Table 3.).

Table 3. International Conventions and Policy Frameworks related to Biodiversity Conservation, pre 1992 and post-1992.

Pre-1992:

- World Heritage Convention
- Convention on International Trade in Endangered Species of Fauna and Flora (CITES)
- Convention on Wetlands (Ramsar)

Post-1992:

- Convention on Biological Diversity
- UN Convention to Combat Desertification
- UN Framework Convention on Climate Change
- Agenda 21: Programme of Action for Sustainable Development
- Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture

- FAO International Treaty on Plant Genetic Resources for Food and Agriculture
- World Summit on Sustainable Development – Plan of Implementation
- National Biodiversity Strategies and Action Plans
- 2011-2020 U.N. Decade on Biodiversity and 2020 Biodiversity Strategy & Aichi Targets
- 2015 U.N. Sustainable Development Goals (Life on Land/Life in Water)
- 2020-2050 Global Biodiversity Framework (currently being negotiated)

Since then, the wide range of international initiatives from the international community and national responses to these initiatives taken by governments has transformed biodiversity and sustainable development policies. These include, for example, the Convention on Biological Diversity itself and the other Rio Conventions on Climate Change and Desertification adopted in 1992 and Agenda 21 - the Sustainable Development Programme. The most recent will be the post-2020 Global Biodiversity Framework that is currently being negotiated, including goals and targets for biodiversity conservation to be achieved by 2050, with action targets for 2030.

This increasing international dimension is certainly a consequence of the growing environmental crisis and the failure of individual countries to adequately address biodiversity issues. It is also a consequence of greater recognition of the growing environmental challenges in reversing biodiversity loss and climate change and the lack of a will, or available resources to address these challenges.

CONCLUSION

Nevertheless, what an exciting future there is for the world's historic botanic gardens! We recognize the monumental challenges be have to ensure we preserve, cherish, appreciate and learn from our past, but we realise that we need not, and must not become hostages to that past. We need to evolve and adapt our responses to these challenges and utilize new technologies, techniques and cooperative and coordinated approaches. I believe that we can go forward with confidence together to contribute to tackling some of the world's greatest challenges in stopping biodiversity and habitat loss, addressing climate change, eliminating poverty and inequalities for the world's people– indeed botanic gardens can contribute to all of the 17 priorities of the U.N.'s Sustainable Development Goals (Sharrock & Wyse Jackson, 2017).

The world's botanic gardens are hugely diverse, but from that comes their strength. Together we can and must ensure that we live up to our potential and contribute to ensuring that botanic gardens are the world's greatest advocates and agents for change and action to ensure that the world's plant diversity can be sustained for future generations. We stand at a crucial time, perhaps more crucial than ever before in our shared histories. We must not fail.

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THEME 2: BOTANIC GARDENS AND THE INTRODUCTION OF ECONOMICALLY IMPORTANT SPECIES

THE ROLE OF BOTANICAL GARDENS IN THE TRANSFER OF SPECIES OF ECONOMIC INTEREST. DO WE KNOW THE FULL STORY?

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ABSTRACT: There are many well-known chapters in the history of botanic gardens about their role in the transfer of plant germplasm, species of economic interest and associated traditional knowledge, between continents and distant cultures, an important component in their history and that of mankind. We have spoken and written many times about their protagonists and some episodes of this history have become - we would say today - trending topics. This is the case, for example, of the role played by the botanical gardens of the Italian Renaissance during the 16th century, or that of the Leiden Botanical Garden and the activity of its director, Charles l`Ecluse, in the promotion of bulbous plants from the Mediterranean

peninsulas and the Near East, or that of the leading role played by Kew Gardens in the introduction of species throughout the British Empire during the 18th, 19th and 20th centuries (Hernández Bermejo, 1995). But other cases have been much more neglected and barely noticed by the responsible and scientists of botanical gardens. These are chapters of this history that we would like to bring out of oblivion. Here are some examples in chronological order:

1) The case of Persian gardens: From the time of Pasargadae under Cyrus the Great and Persepolis under Darius I, and later in the history of Persia (e.g., during the Seljuk reign), Persian gardens served not only as a link between East Asia and Mediterranean cultures, but also as a platform for the domestication and selection of numerous food and ornamental crops (pistachio, pomegranate, saffron, tulips).
2) The gardens of al-Andalus during the 10th-14th centuries (Cordoba, Toledo, Seville) and their great role in the introduction of food, medicinal and ornamental species between the Near East, North Africa, and SW Europe (eggplants, rice, sugar cane, citrus fruits, love trees, paradises, chinaberry tree, tulips too!) Species that thanks to their introduction in Spain, Italy or Portugal, later traveled to America.
3) Renaissance and Enlightenment gardens in Spain: missed opportunities, lost gardens but often successful transfer of species.
4) The Jesuit missionary gardens and orchards in the Guarani area (XVII and XVIII centuries) where some of the species arrived from South America.
5) The botanical gardens of the Caribbean during the 18th and 19th centuries and their role in the introduction of Asian spices (cinnamon, indigo, cloves, pepper, nutmeg).

An forgettable chapters in this exciting history of botanical gardens that must be rediscovered

KEYWORDS: Botanical Gardens, plant germplasm transfer, Persian gardens, al-Andalus gardens, gardens of the Enlightenment, Jesuit missionary orchards, Caribbean gardens.

INTRODUCTION

The transport and dissemination of plant species of economic interest is an important chapter in the history of mankind. Botanical gardens have been part of this chapter and it is also an important component of their own history.

In the Old World there are numerous and very old antecedents of botanical gardens and expeditions promoted by them for the transport and acclimatization of cultivated plants. In them, in addition to this process of introduction and diffusion, there has also been part of their domestication and various phenomena of re-signification. 3,500 years ago, in the Egyptian empire during the XVIII dynasty, the pharaoh Thutmose III developed a great constructive activity, building several temples in Thebes and Karnak, and had a special interest in aspects of botany and zoology, as evidenced by the walls of the so-called "botanical garden of Karnak", which present animals and plants possibly from Syria and Lebanon.

In this function of prospecting, cultivation and transfer of species of economic interest between cultures and continents, certain chapters and protagonists are especially well known in the universe of botanical gardens, which have become, we would say now, "trending topics". But there also existed in different times, cultures and geographies, especially during the Ancient and Middle Ages, gardens -less known- that deserve to be considered botanical gardens because, in addition to their careful design and the care with which they were cultivated, they were centers of concentration of plant diversity, receiving species from other places, observing their properties, acquiring experience in their cultivation and disseminating their germplasm and utilities in other territories. We have examples of this in the Persian, Hellenic, Roman and Islamic-medieval cultures. Also in other continents such as America, similar experiences

were lived in flourishing cultures such as those of the Mayan, Olmec, Aztec or Inca worlds.

SOME WELL-KNOWN CASES

Renaissance Gardens: Italy

From the sixteenth century and during the seventeenth and eighteenth centuries the botanical gardens of the Mediterranean countries (today Spain, Italy, Portugal, for example) played a decisive role in the introduction and consolidation of American species as crops. The botanical garden of the University of Pisa was created in 1544 thanks to the initiative of Luca Ghini, physician and botanist, with the financial support of the Duke of Tuscany, Cosimo I de Medici. Its original location was different from the present site because in 1563, under the direction of the botanist Andrea Cesalpino, it was transferred to the north eastern sector of the city. In the same year, his disciple Francesco Bonafede, created in Padua the Hortus Cinctus, which is still preserved in the same place and maintains its original structure (Garbari and Raimondo, 1986). The impulse of creation of botanical gardens in Europe had ignited and moved like a lit fuse through many different countries. Following the example of these first gardens, those of Antwerp (1548), the Vatican (1566), Bologna (1567), Leyden (1575), Leipzig (1577), Amsterdam (1582), Basel (1588), Heidelberg (1593) and Montpellier (1593) were founded. Already in 1544 Mattioli mentions the culinary use of *Cucurbita pepo* and *Phaseolus vulgaris*, and we have to wait a little longer to find the mentions of the tomato or the numerous American subtropical fruit trees such as the cherimoya, avocado or papaya. Italian botanical gardens such as those of Pisa and Padua were no strangers to these processes:127 species were introduced in the 16th century and 58 more in the 17th century. Among those were *Celosia cristata, Canna indica*, *Passiflora coerulea* (through Venice), *Solanum tuberosum, Lycopersicum esculentum,Agave americana* (through Padua), *Opuntia ficus-indica* (in 1565), *Helianthus tuberosus* and *Ipomea batatas* (Saccardo, 1909; Garbari and Raimondo, 1986).

Renaissance Gardens: Leiden Botanical Garden

A Renaissance Garden of singular prominence was the Leiden Botanical Garden thanks especially to the activity of its director, Charles l`Ecluse (Clusius) in the promotion of bulbous plants from the Mediterranean peninsulas and the Near East. This particular issue was discussed at a monographic conference held in Leiden in 1991 (Tjon Sie Fat and de Jong, 1991). Clusius had not only traveled and collected in a large part of the southern European territories, from Hungary to the Iberian Peninsula, but also, closely related and integrated in an international network of correspondents who sent him plants from different countries, he managed to enrich the Leiden collections with numerous species of ornamental interest. For this he even used Sir Francis Drake as an intermediary, with whom he maintained (according to an epistolary preserved in the Leiden library) a commercial agreement, so that although the gold from the Spanish galleons was "diverted" by Drake to English ships, the plants brought from the New World found their final destination in Leiden.

The collections of Clusius' Garden grew rapidly, reaching nearly a thousand in 1601, among which were oriental crops such as *Saccharum officinarum, Zingiber oficinale*, *Ricinus communis* and various citrus fruits, together with numerous American species such as *Mirabilis jalapa, Solanum tuberosum, Lycopersicum esculentum, Capsicum annum, Opuntia ficus-indica, Canna indica, Tropaeolum majus, Nicotiana tabacum, N. rustica*, *Thuja occidentalis, Argemone mexicana, Celosia cristata, Agave americana* and various species of *Passiflora.* (Veendorp y Becking, 1938, Jan de Koning, 1993).

After Clusius' time at the head of the Leiden Botanical Garden, the Leiden Botanical Garden continued to play a prominent role in the introduction of plants. Between 1633 and 1649 many species arrived from NE America and from 1680 onwards a third period of introductions took place, with mainly ornamental plants from North America and South Africa including *Liquidambar stiraciflua, Platanus occidentalis, Liriodendron tulipifera, Juglans nigra and Phytolacca americana*.

By the way, it was not Clusius and the Leiden Botanical Garden who were the first to describe and cultivate tulips in Europe in the 17th century, but a Toledan agronomist in the 11th century, Ibn Bassal, who introduced and cultivated them in the garden of Sultan al-Ma'mum in Toledo, and a botanist from Seville who described them in the same century, 500 years earlier. We will come back to this point later.

18th and 19th centuries. The predominant and best-known role of Kew Gardens

From the 18th century onwards, botanical gardens began to solve the difficulties of climatic adaptation of plants arriving from overseas, generally from tropical or subtropical environments, either by locating the new "acclimatization" gardens in territories with those climates (colonial gardens) or by creating gardens in European metropolises, equipped with enormous glass houses or greenhouses that were progressively built on a larger scale and with an ambitious design. The Royal Gardens of Kew, created in 1750 but opened to the public and destined to become a Botanical Garden from 1840, stood out among all of them. Its prominence and effectiveness in the introduction of species from other regions of the world was a constant throughout its history. In 1768 John Hill catalogued about 3000 cultivated species; at least 500 of them were allochthonous trees and shrubs, mostly from North America. Colmeiro (1894) mentions how these gardens were already famous in 1789 for their collections of exotic plants. Desmond (in Hepper, 1989) recognizes textually that "the demand for new plants and seeds manifested by the enthusiastic botanists and gardeners of Kew in the middle of the 18th century was insatiable".

One of the most active characters in this process at Kew was Joseph Banks (Desmond in Hepper, 1989), Naturalist, participated as a young man in the famous expedition of the Endevour, captained by Cook across the Pacific thanks to which the first specimens of Australian *Eucalyptus* reached Europe. The gardens of Calcutta and Jamaica were among the most generous donors. In this way and during the reign of George III more than 7000 foreign species were introduced at Kew. Sir Joseph Banks was the driving force behind this process and always paid special attention to species of economic interest. It was Banks who arranged the transfer of breadfruit from Tahiti to the West Indies on HMS Bounty. Among the most important collectors at Kew were e.g. Pantaleon Hove (in Africa) and David Nelson, the gardener who accompanied Captain Bligh on board the Bounty. This story theoretically focuses on a transport of the bread fruit tree from Polynesia to the British colonies in the Caribbean.

But perhaps the best-known story of all the introductions at Kew Gardens is that of the rubber tree (*Hevea brasiliensis*), which was transferred from Brazil to Ceylon. Initially, after the discovery of the vulcanizing process in 1839, rubber was collected by cutting wild *H. brasiliensis*trees in the Amazon rainforests. As the value of rubber gradually increased, the Brazilian government banned the export of seeds, but despite this, an Englishman named Farris obtained some in 1873 and sent them to Kew. There he made them germinate and then they were transferred to the Botanical Garden of Calcutta (India) where they were lost. But in 1875 another Englishman, Henry Wickham managed to get about 70,000 seeds out of Brazil by outwitting (bribing?) the authorities of that country and took them to Kew, where they arrived alive only in 1900, but with them and sent back to the Asian tropical colonies, very soon the rubber industry emerged in Ceylon, Malaysia and Indonesia. Today this history would be challenged under the Access and Benefit Sharing framework and Nagoya Protocole (Convention on Biological Diversity).

OTHER LESSER-KNOWN CASES

Other cases have been much more neglected and barely noticed by the managers, technicians and scientists of botanical gardens. These are chapters of this history that we would like to bring out of oblivion. Here are some examples in chronological order:

1) Persian garden

We are 2,500 years ago, in the Persian gardens built by Cyrus II around his palace of Pasagarda and in those the Persepolis of Darius I (figures 1 y 2) in a framework of imperial cities, which were showcases of power. The bas-reliefs on the stairways of Persepolis show trees such as cypresses, cedars and pines alternating with dozens of ambassadors from other countries, each bearing gifts and goods. Persian gardens, not only under the Achaemenid Empire (539-331 B.C.) but also throughout its subsequent empires and cultures - Seleucid (331-141 B.C)., Parthian (141 B.C.-224 A.D.), Seljuk (1037-1094) - were intermediaries between the plant genetic resources of East Asia, Africa and Europe, andthey boosted the use and dispersion of the autochthonous plant heritage of the Near East: *Pistacia vera, Punica granatum, Papaver somniferum, Vitis vinifera, Morus nigra, Ceratonia siliqua, Malus sylvestris, Crocus sativus, Spinacia oleracea, Allium cepa, Allium sativum, Linumusitatissimum, Tulipa spp, Daucus carota, Berberis spp., Melia azederach, Elaeagnus angustifolia....*

2) Jardines de al-Andalus

Al-Andalus is the territory dominated by the Hispano-Muslim culture, progressively reduced in area from the 8th to the 15th century. It is not a constant or concrete surface or even a past time. Al-Andalus was above all a historical process, dynamic, essential to understand the history and essence of Europe. It was not the consequence of a military invasion, nor of a conversion to a religion opposed to Christianity. In al-Andalus a cultural, artistic, scientific and even religious process took place, which was several centuries ahead of the Renaissance in the rest of Europe. (Hernández Bermejo y García Sánchez, 1998, 2009).

In this space, time and culture flourished spectacular gardens linked to palaces and alcázares in cities such as Cordoba, Seville, Toledo, Zaragoza, Ronda or Granada. Famous examples are the gardens of Madinat al-Zahra in Córdoba, Alcaicería in Zaragoza, or those of the Alhambra and Generalife in Granada. But there were also authentic botanical gardens such as those of Cordoba (that of Abd al-Rahman I in the Arruzafa and that of Abd al-Rahman III on the banks of the Guadalquivir), Toledo (that of Sultan al-Ma'mum) and Seville (with Sultan Al-Mu'tamid). There were many agronomists and botanists linked to these gardens such as ʻArīb b. Saʻīd (10th century), Ibn Ḥaŷŷāŷ (11th century), Ibn Baṣṣāl (11th century), Abū l-Jayr (11th –12th centuries), al-Ṭignarī (11th –12th centuries), Ibn al-ʻAwwām (12th-13th centuries) and Ibn Luyūn (14th century), and physicians and pharmacologists such as Ibn Ŷulŷul (10th century),Maimonides (12th century) and Ibn al-Bayṭār (13th century). Important pharmacologists such as Ibn Ŷulŷul (10th century), Ibn Wāfid (11th century), Maimonides (12th century) and Ibn al-Bayṭār (13th century) also emerged within this framework. Also noteworthy is the impressive botanical treatise (an authentic flora of al-Andalus) attributable to Abū l-Jayr, entitled ʻUmdat al-ṭabībfīmaʻrifat al-nabāt (the key book for a physician's knowledge of botany), that contains about 5000 records of plants, often accompanied by lengthy descriptions, references to uses and qualities, and interesting place names. In these gardens, in addition to the writing of important treatises on botany and agriculture, the introduction and cultivation of new food crops, ornamental, medicinal plants or for industrial or artisanal use from the Near East, North Africa and SW Europe took place. Among others: eggplants, rice, sugar cane, citrus fruits, love trees, paradises and even tulips). Species that, thanks to this introduction, immediately traveled towars America.

Part of the authors of this contribution form, a small but enthusiastic group of Arabist and ethnobotanical have devoted a good part of our life to the recovery of this botanical and agronomic culture lived in al-Andalus (Hernández Bermejo, García Sánchez y Carabaza Bravo, 2012; García Sánchez, Carabaza Bravo y Hernández Bermejo, 2021).

3) The Renaissance and the Enlightenment in the Iberian countries: lost opportunities

a) Renaissance

In Spain Andrés Laguna in his version of the Dioscorides had already proposed in 1555, the creation of a botanical garden and very soon the project arose impelled by Felipe II promoting in Aranjuez, near Madrid, the creation of one that

would lodge the plants arrived from America to the port of Seville. A royal decree of 1558 ordered its creation. The architect Juan Bautista de Toledo tried to combine practical objectives with a beautiful Renaissance design in the "Garden of the Island" and upon his death in 1567, Juan de Herrera completed the work with other important works in the area, such as the Ontígola dam or the navigation of part of the Tagus River. But unfortunately, many of the plants shipped in the ports of the West Indies did not reach Aranjuez, because those that managed to avoid the English, Dutch and Turkish piracy and reached Seville, died later during transport to this town, under the cold winters of the Tagus valley. We find records of the species that came to be cultivated in the Gardens of Aranjuez thanks to Gregorio de los Ríos (1592, 1620 in Porras and Armada, 1991). Some of them, with time, did become important as crops and food in Europe. This is the case of *Phaseolus vulgaris, Capsicum annuum, Helianthus annus* or *Lycopersicum esculentum*, while others remained underutilized or cultivated as simple ornamentals (*Canna indica, Tropaeolum majus, Amaranthus* spp.). In 1577 Francisco Hernandez, Felipe II's protomedic, returned from Mexico, accompanied by 68 bags of seeds and roots in 8 barrels and 4 buckets with trees and medicinal herbs, including corn (*Zea mays*), tropical pineapple (*Ananas comosus*), sweet potato (*Ipomoea* pp.) and several varieties of chili peppers and peppers (*Capsicum* spp.).

In Seville and the dawn of this process there were also some humble and almost private gardens of some doctors such as Nicolás Monardes, Francisco Franco or Juan de Castañeda, who mitigated the failure of the garden of Philip II. Nicolás Monardes (1565-1580) mentions many American species that he himself cultivated in his Sevillian garden, such as jalapa, sassafras, guaiacum (*Guaiacum officinale*), tobacco, balsam of Tolu (*Myroxylon toluifera*), tropical pineapple, peanuts, corn, sweet potato, coca or sarsaparilla. Monardes was not the only private botanical garden in Seville. Simón Tovar, for example, kept one of exotic plants at the end of the 16th century.

Also in Valencia, during the Renaissance, there was a first attempt to create a chair and botanical garden at a time when the port of Valencia was a bridge to Italy. Melchor de Villena installed in 1631 an orchard as a didactic support for his classes, to which species of the American flora must have arrived through the Italian ports. Valderas (1992) highlights this role and specifically mentions the exchange between Valencia and Tuscany.

b) The Enlightenment in Spain:

The impulse for the creation of new botanical gardens during the reign of Charles III (1759-1788) with the support of the Ministers of the Indies José de Gálvez and Antonio Porlier, and the technical reports of Casimiro Gómez de Ortega as director of the Royal Botanical Garden of Madrid, gave impetus to the birth of gardens or propagation nurseries such as those of Puerto de Santa María, Málaga, Cartagena, Vélez-Málaga or Córdoba. The latter remained in Andrés Palacios' project with a simple initial collection of plants (García Abasolo and Rodríguez García, 1978). They were gardens of ephemeral life and little prominence, and hardly left any evidence of their possible role in the transfer of species. The aforementioned Ministers of the Indies Gálvez and Porlier supported these projects as Acclimatization Gardens in view of the success that was already being obtained at that time with the cultivation of species such as sweet potato (*Ipomoea batata*), jalapa *(Ipomoea purga*) American squash (*Cucurbita* spp.), yucca (*Manihot esculenta*), sarsaparillas (*Smilax* spp.) malaguetas (*Aframomum melegueta*), cherimoyos (*Annona cherimola*) and zapotes (*Manilkara zapota*), among many other species.

Later, in 1777 in a botanical garden of acclimatization that must have existed in Puzo (Valencia) there are references to the introduction of the cherimoya (*Annona cherimola*). From there and after a few decades it would begin to be cultivated in the orchards and gardens of Valencia, Orihuela and Malaga. Boissier already saw it planted in the latter city

in 1835. Also, the botanical garden created by Lorente in 1802 (which is the one that has survived to the present day) and in spite of the ravages of the War of Independence with the French, must have played an important role in the introduction of plants from other continents. There are data on the arrival of the peanut to Spain through this Garden Orotava.

Thanks to the work of Rodríguez García (1979) investigating the documentation preserved in the Archivo de Indias of Seville on the arrival of Asian and American species to the Botanical Garden of La Orotava during the 18th century, we can know part of the role played by this Garden. Shipments of plants from transoceanic regions began to arrive in Tenerife in 1788 from the Philippines, East and West Indies. Among the plants of food interest arriving from America were various species of gourds, urucu (or achiote, *Bixa orellana*), beans (*Phaseolus* spp.), papaya (*Carica papaya*), cashew (*Anacardium occidentale*), Indian cress (*Tropaeolum majus*) and several species of *Annona* (including *A. squamosa*) (Hernández Bermejo, 1995).

The leadership and success achieved by the Royal Botanical Garden of Madrid from its definitive location in 1782 in the Prado de Atocha, for its botanical expeditions to America, as a centre of taxonomic studies, as a place of collection of herbariums and bibliographic documents and for the publication of important Floras from the expeditionaries who traveled the New World (Celestino Mutis, Hipólito Ruiz, José Pavón, ...) is indisputable. But in spite of all this and its character as a garden attached to the court and government of Spain, the Garden of the Metropolis did not achieve effective results in the introduction and transfer of species and specimens. The climate prevented it, and also, probably, the absence of a decided project of agronomic implications, as well as the absence of large greenhouses and glass houses (with the exception of the Villanueva Pavilion).

During the reign of Charles IV and more specifically at the urging of Godoy, a Royal Order was promulgated for the creation of 24 botanical gardens in Spain, an ambitious project that was soon cut short with the Mutiny of Aranjuez in 1808, the fall of the aforementioned Prime Minister Godoy and immediately the Spanish War of Independence against the French invasion. The gardens of the Enlightenment will soon be identified as examples of "Frenchness" and the gardens of the Enlightenment will fall into oblivion. One of the most regrettable examples of this process is what happened with the Botanical Garden of Sanlúcar de Barrameda, one of the 24 of that Royal Order, promoted by Francisco Amorós and vehemently supported by Godoy himself, who sent argan seeds (*Argania spinosa*) to those initially responsible for that garden for its cultivation (designed by Esteban Boutelou, directed by Francisco Terán and with Rojas Clemente as the first professor of agriculture). The seeds had been sent by the Spanish consul in Morocco and there are data on their germination and first plantations). Along with the argan trees, the cultivation of other recently introduced species such as balsam trees from Peru, mangroves from Louisiana, carob trees from Chile (*Prosopis* spp.), catalpas and guayacanes was being tested. The garden was razed by the populace who identified the project as an initiative of Godoy and not even during the Restoration of the Monarchy after the expulsion of the French, under the regrettable reign of Ferdinand VII, was it possible to recover the garden whose land and facilities were ceded to the Dukes of Montpensier (Cabral Chamorro, 1995).

c) Jesuit missionary orchards in the Guarani area (South America) 17th and 18th centuries

Between the 17th and 18th centuries, the Order of Jesus promoted an agricultural and cultural emporium through the creation of a network of Missions ("Reductions") in the Guarani indigenous settlements located along the

Paraná and Uruguay rivers (territories that today belong to Brazil, Argentina and Paraguay). The role of the Jesuits had not only religious and socio-economic consequences, because the Jesuit Reductions became authentic agricultural emporiums in which the Jesuits introduced numerous cultivated species from the old continent and at the same time learned the utilities and forms of consumption of many plants of the flora of the Atlantic-Guarani and Chaco forests and promoted their cultivation and domestication. The result was a powerful process of transfer in both directions: from the Amerindian cultures to the European cultures (and therefore also to Asia and Africa) and from the latter to the nascent South American agriculture. Among the crops introduced were, for example, numerous citrus trees (lemon, lime, mandarin, orange), pomegranate, quince, apple, pear, fig, several varieties of grapes, peach, sugar cane, rice, safflower, chicory, cucumbers, spinach, cabbage, turnips, radishes, mustard, peas, coriander, fennel, parsley, anise, rosemary, mint,... Some of the Asian species introduced must have arrived directly from the Jesuit missions on that continent. Among them, some as unique as *Hovenia dulcis, Toona ciliate*, *Vernicia fordii* or *Zingiber officinale*. As living proof of those introductions, some feral citrus trees such as the bitter orange tree or "apepú" (*Citrus x aurantium* L.) or the "lemon mandarin" (*Citrus x taitensis*), are still present in the Atlantic "missionary" forests.

Reciprocally, the Jesuits knew and cultivated species such as *Ilex paraguaiensis* (yerba mate), *Syagrum romanzoffianum* (pindó palm), *Araucaria angustifolia* (Paraná pine). *Ananas comosus* (pineapple, ananas). *Cucurbita* spp. (pumpkins), *Arachys hypogea* (peanut), *Manihot esculenta* (cassava), *Theobroma cacao* (cacao), *Chenopodium quinoa* (quinoa), *Canna edulis* (achira), *Bixa orellana* (achiote, bixa, urucu), *Zea mays* (maize, corn), or *Phaseolus* spp. (beans, beans, beans, beans, beans).

The role of the Jesuits was decisive in the domestication of new crops from the local flora, which until then had been used almost exclusively for extractivism, such as pineapple, cassava, American cotton (*Gossypium hirsutum*), peanuts, various species of pumpkins and a special and important case for the future agriculture, food, economy, ways of life and customs of the region: yerba mate (*Ilex paraguaiensis*).

The scenario of this process was constituted by orchards of different dimensions, design and objectives: next to the monastic or private orchard of the Jesuits, there was the *Tumpambaé* or community orchard, the *Abambaé* (family orchards of the Guarani) and the domesticated forest (which continued to be subjected to the extraction of certain species). But also around the buildings that made up the Reduction (Church, Jesuit and Guarani family residences, artisan workshops, latrines, and *Cotiguazú*, the residence of single women and widows) there was a landscaped cemetery and around the Jesuit Residence an orchard-garden with a marked design probably inspired by the canons of the European Baroque, with a design reminiscent of those proposed by Olivier de Serres in his treatise on gardening (1600) divided into: *Potager* (vegetable garden), *Bouquetier* (ornamental garden of flowering plants and color), *Medicinal* (simple garden) and *Fruitier* (garden or orchard of fruit trees) and that were of decisive influence in the development of Central European gardening during the seventeenth century and early eighteenth century. We are therefore faced with authentic botanical gardens for the introduction, testing, propagation and domestication of new crops. An important milestone in the process of crop transfer between cultures and continents.

The transfer of species between continents carried out by the Jesuits and the phenomenon of their Missions in the southern regions of South America continued even after their expulsion from this continent. The history of the Orto Botanico Vaticano and the role played by Gilii and Xuarez prove it. Many species later traveled from America to Rome as a result of this chapter in the history of missionary orchards and gardens in the Guarani area.

d) Botanical Gardens of the Caribbean during the 18th and 19th centuries

These gardens played an important role during the 18th and 19th centuries in the introduction of Asian spices such as cinnamon, indigo, cloves,

pepper, and nutmeg. Howard (1953) tells the story of the origin and function of the Caribbean botanical gardens. It seems that they developed because of a political strategy nourished by international intrigues, in the struggle for control, between the end of the 17th century and part of the 18th century, of products derived from Asian tropical species, especially spices. During the 17th century, the Dutch controlled the spice trade from the South Sea islands. To break this monopoly, the French and the English sought the same species in other Pacific islands and tried to introduce them into their colonies in the West Indies (Caribbean) following the example of other Asian or African tropical crops that had already been brought to America during the 16th century (such as sugar cane or bananas introduced from the Canary Islands after 1493).

In the case of coffee, the French were responsible for the arrival on the island of Martinique in 1720 of seeds from a single sapling that came from the *Jardin des Plantes* in Paris, and the Dutch did the same thing around the same time from a single specimen from the Botanical Garden of Amsterdam (Eeeren, 1995). In England, in 1758, the Royal Society of Arts organized a prize competition to encourage tropical agriculture and horticulture, promising the first prize to whoever brought mango (*Mangifera mango*) seeds to England, from where they would be sent to the West Indies for cultivation. Prizes were also offered (in 1760) for the introduction of other species such as cinnamon, indigo, cotton, vanilla, cloves, pepper, camphor, cinchona, annatto, nutmeg, poppy, safflower, breadfruit, etc. Thanks to these incentives, the English and French began to cultivate these species and spices in their American colonies, although a new problem soon appeared: the farmers of the Caribbean colonies sought their personal profit and did not favor the dispersion of the crop, so the need to create "official" nurseries where these plants could be propagated and offered at a moderate price began to arise.

Thus, the botanical gardens of the Caribbean were born in the 18th century. A brief chronology of their sequence of creation could be, following Howard (1953) and Leiva (1991) could be: St. Vincent (1765); Jamaica, Port-au-Prince (Haiti), Fort de Franca (Martinique) around 1775; Trinidad (1818); Grenada (1886), St. Lucia (1887); Carracou (1889); Dominican (1891); Antigua (1896); Barbados (1896); St. Kitts (1896) and Tobago (1899).

Final reflection

After mentioning these cases we would like to propose the constitution of an international working group that could be able to compile a summary of case studies of this exciting history of botanical gardens, incorporating lesser-known chapters, and to analyze the processes of transfer, transculturation, resignification and diffusion of many of the species of economic interest carried out by botanical gardens.

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THEME 3: HISTORY IS NOW – DOCUMENTING AND PROTECTING CONTEMPORARY GARDENS FOR POSTERITY

HISTORY IS NOW – DOCUMENTING AND PROTECTING CONTEMPORARY GARDENS FOR POSTERITY

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ABSTRACT

History is not static, but a process in space and time. Thus, also botanic gardens permanently face changes regarding their missions, their collections as well as their buildings or their design.

Potential reasons for such changes are manifold: administrative, scientific, budget-driven, staff-related, society-related, "fashion"-driven, or target group-orientated, to mention only a few. Often such changes (and even rationales for new developments) are also reflected in mission statements.

"Documentation" is a flashlight at a certain point of a historical development process. To secure meaningful documentation it is important to have clear reference data related to all kinds of changes in a botanical garden. Such reference data help future generations to decide which elements of botanical gardens could be valuable for protection.

"Protection" of botanical gardens should not be a value per-se. It must be meaningful and shall not negatively interfere with the mission and tasks of a garden. Arguments what to consider worth protecting might change over time. They might include, i.a., the scientific value and/or the uniqueness of collections, or buildings and/or garden designs typical for certain periods.

Looking back into the past, and using examples from contemporary "historical" gardens, the talk will present ideas how we can "prepare" botanical gardens for a meaningful documentation and protection for future generations.

THEME 4: MANAGING HISTORIC BOTANIC GARDENS (PROBLEMS AND ISSUES): PRESERVING THE PAST WHILE RESPONDING TO CONTEMPORARY NEEDS.

Tourist routes and Portuguese historic botanical gardens

Teresa Andresen

President of AJH – Portuguese Association of Historic Gardens

ABSTRACT

Culture and nature based touristic routes, such as historic garden routes, contribute to distinctiveness and authenticity in the perception of the value and meaning of heritage. Historic botanical gardens are of special interest also because of their scientific dimension. The role of botanical gardens is evolving according to new society needs, such as adaption to climate change, as centuries old living laboratories where important plant species from a diversity of geographies grow and have acclimated to their living ecosystem. Besides their historical value, richness of built and living elements, herbariums, collections or books, when visited they offer a unique stage for the debate on autochthons versus allochthons, indigenous versus exotic, productive versus ornamental, aromatic, medical or invasive species.

Tourism is an important means of enhancing culture, nature and landscape for the bonds and synergies it creates among property owners, managers, operators and visitors as well as for the income it generates that can be applied in heritage conservation and maintenance. The 12 touristic routes of historic gardens of AJH, the Portuguese Association of Historic Gardens, have been organized between 2019-2020 with this motivation. Marketing is on the way - still much under the influence of the pandemia - aware that gardens as a touristic product are part of complimentary offer to be shared with other products such as the offer of accommodation, catering, nature walks, wine or horses. The 12 routes include the three botanical gardens in Lisbon, Coimbra Botanical Garden, Porto Botanical Garden and Madeira Botanic Garden. However, the touristic routes include other gardens with a significant plant heritage both autochthons and exotic.

THEME 5: TOURISM OPPORTUNITIES FOR HISTORICAL BOTANIC GARDENS

TOURISM & FUNDING FOR GARDEN

NUNO OLIVEIRA

Technical Director of Parques de Sintra

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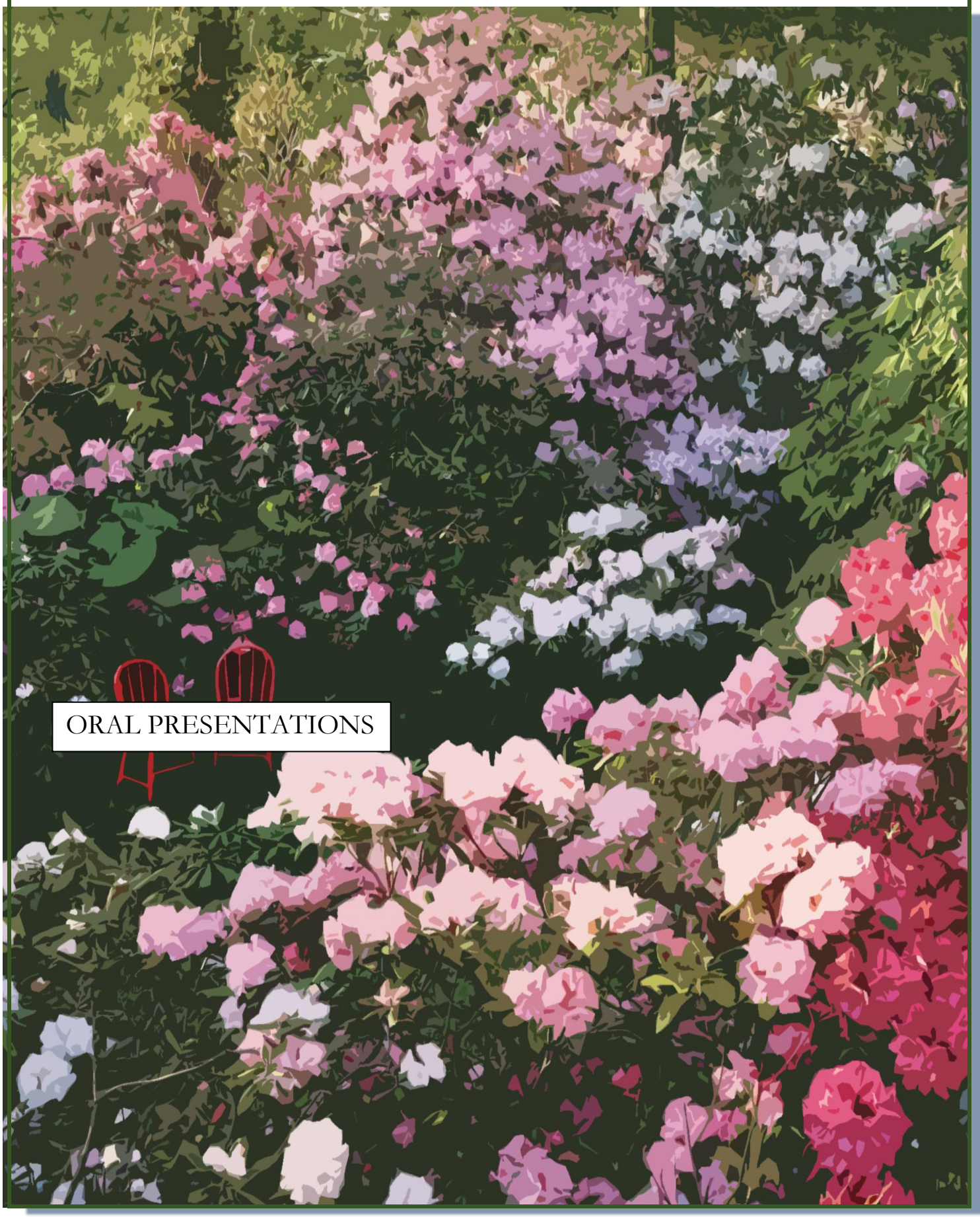

ORAL PRESENTATIONS

ORAL PRESENTATIONS

THE PLANT COLLECTION OF THE AUSTRIAN FEDERAL GARDENS

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ABSTRACT

Dating back to 1569, the Plant Collection of the Republic of Austria maintained by the Austrian Federal Gardens contains now more than 130.000 specimen representing around 16.000 species and sorts from all regions of the world. More than 450 years ago the Habsburgian caesarean collection of plants started as a part of the cabinet of curiosities. The early beginnings can even be traced back in the first half of the 16th century. Due to the royal interest in collecting things, objects were gathered randomly with the aim of getting a complete collection of curiosities.

The 18th century brought a clear structure into the collections and clear orders in enlarging the stocks. Plants were collected out of economic reasons, nutritional and/ or medical reasons and sovereign representation needs. The Habsburg Empire organized expeditions well beyond its own dominion. Trading, exchanging, and acquiring practices helped to establish one of the biggest botanical gardens of that time in Vienna. During the second half of the 19th century, the focus increasingly changed to the targeted collection for conservation of species and completing existing botanically prioritized focus collections.

Nowadays the Plant Collection of the Austrian Federal Gardens is an important gene pool, supporting research facilities and science and make an important contribution to the national and international species conservation. On top of it, the Plant Collection of the Austrian Federal Gardens is part of the UNESCO world heritage Schönbrunn.

KEYWORDS

historical botanical collection, Vienna, Schönbrunn, garden history, history of botanical collections, keeping biodiversity ex-situ

INTRODUCTION

In most cases, botanical collections have an academic background and are related to universities or research facilities. The "giardini dei semplici" of Pisa, Padova, Pavia and many others were established for collecting and curating medical plants and were normally run by professors of botany at medical faculties. These botanical collections are thus defined by living plants and herbaria, scientific research and education.

However, there were also many botanical collections related to noble or royal gardens established all over Europe especially in the 16th and 17th century, for example Kassel or Stuttgart in Germany. Most of these collections got lost over the centuries out of various reasons. One of the few still existing and flourishing former royal botanical collections is the one of the Austrian Federal Gardens in Vienna, until 1918 the Imperial botanical collection of the Habsburg family and since then the Plant Collection of the Republic of Austria.

MEANING OF EARLY ROYAL BOTANICAL COLLECTIONS

The early beginnings of collections in a modern sense can be traced back in the first half of the 16th century – the time when the orti botanici of Pisa, Padova and Pavia were established. Due to the royal interest in collecting things, objects were gathered randomly with the aim of getting a complete collection, which depicts the whole world, which means art, nature and curiosities. In these so-called Kunst- und Wunderkammern, living plants and animals were part of the collections, but for conservation reasons, they were kept in gardens, glass houses and menageries.

Even though, the focus was laid on curiosity and scientific interest, also representation, presentation of power, symbolic meaning and economical aspects were important factors as well. Emperor Maximilian II. (1527–1576) engaged Carolus Clusius in 1573 as court botanist. Clusius established the first medicinal garden, undertook botanical excursions to the Alps and the Pannonian lowlands and he published illustrated works (Clusius, 1583). Together with Ogier Ghiselin de Busbecq, the Habsburgian ambassador to the Ottoman Empire, Clusius (re-)introduced not only tulips, but also many other bulbs and the horse-chestnut to Vienna and started cultivating them (Lack, 2000). At this time, Vienna and its surroundings were one of the horticultural centers of Europe. As a protestant, Clusius was discharged of the Imperial court after Maximilian's death by Emperor Rudolf II. And as a result he moved on to Leiden.

Not only physicians, botanists or gardeners collected plants, art agents handled the acquisition of plants as well. This fact is also known of other royal courts. In 1455, Giovanni de Medici instructed his art agent to buy paintings, sculptures and living citrus trees for his collections at Villa Medici in Fiesole near Florence (Lillie,

1993). Also Emperor Maximilian II. ordered by his antiquarian and polymath Jacopo Strada artwork, living plants and seeds from Italy for the never finished pleasure residence Neugebäude, in the south of Vienna. Neugebäude was planned as a modern gallery building for the Imperial Collections (Lietzmann, 1987). In the immediate vicinity, art and natural history objects, coins, machines, living plants and living animals should have been presented in the rooms of the chateau, in the surrounding gardens and the menagerie. Unfortunately, Emperor Maximilian II. died in 1576, before the finalization of the construction work and his successors had only little interest to finish the project. More than 450 years ago, the Plant Collection of the Austrian Federal Gardens started existing at this place in 1569.

THE GENESIS OF THE CABINET OF NATURAL CURIOSITIES

In 18th century, significant changes happened to the Imperial Collections as well as to the way of enlarging the collections. Emperor Franz I. Stephan (1708–1765) established the Hof-Naturalienkabinett (cabinet of natural curiosities) in 1748. Slowly a process of separation of the former Kunst- and Wunderkammer started. In addition, the so-called Holländische Garten (Dutch garden) in Schönbrunn was created in 1753 for keeping the living plants. It is located directly adjacent to the Menagerie, which had been built one year earlier (Hajós, 1995).

The acquisition of plants in the 18th century was no longer left to chance. Expeditions were organized to collect living and dried plants, seeds, bulbs and cuttings, living and stuffed animals, molluscs, minerals, artwork and many more objects for the Imperial Collections in Vienna. As the Habsburgian Empire lacked the necessary colonies to order plants, botanists, Imperial gardeners, hunters, painters and many other professionals were sent on expeditions to the Carribean, North- and South America, South Africa and the Mascarenes (Hühnel, 1992; Riedl-Dorn, 2003).

In Vienna, the living plants were cultivated in the green houses of Schönbrunn located in the Holländischer Garten (Baumgartner, 2003) and since 1791 also in the green house on the terrasse of the flat roof of the new Augustinergang (Mader-Kratky, Martz, 2016).

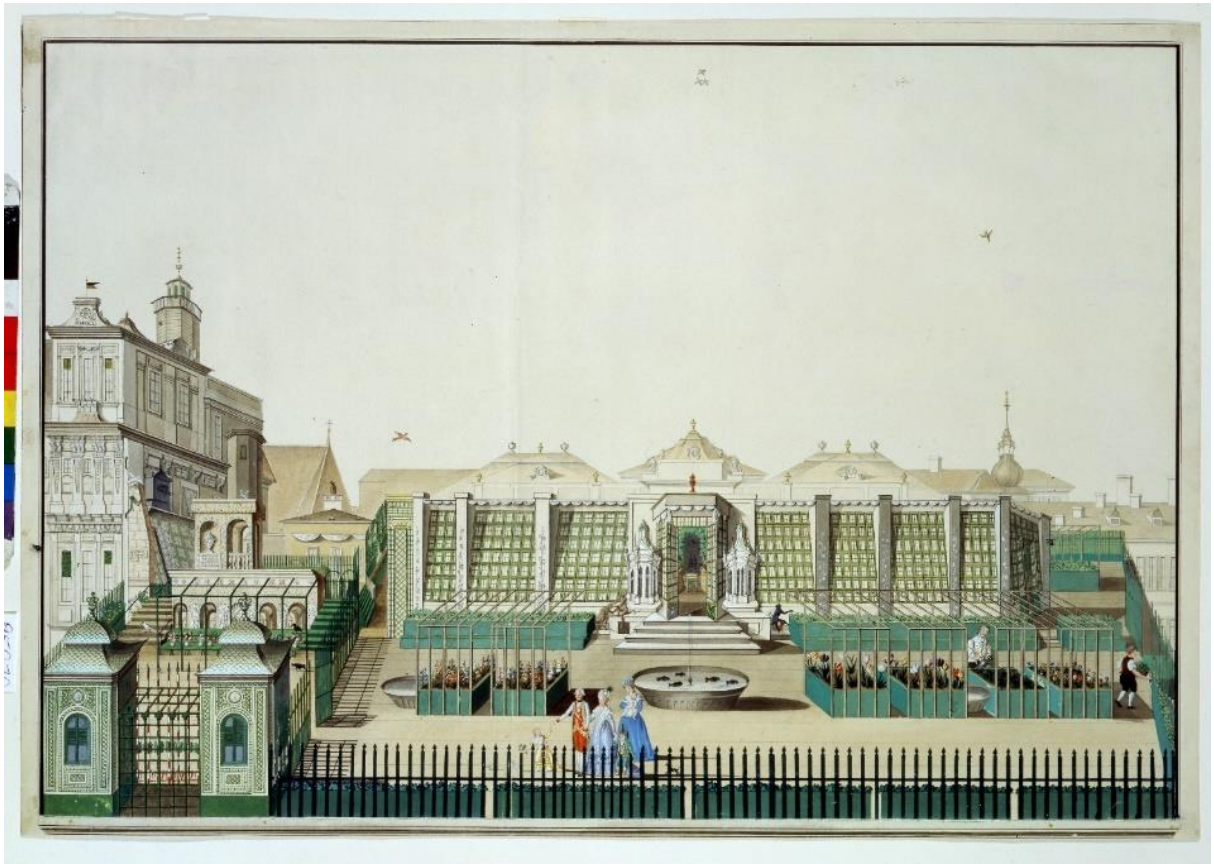
Since 1820 plants were also cultivated in the glass house built by Ludwig von Remy at the Hofburggarten (Martz, 2010). Herbaria, mineralia and other collected naturalia were integrated to the Naturalienkabinett. Living animals were kept in the Menagerie at Schönbrunn.

All opportunities of acquisition were exploited. Beside the already mentioned expeditions, trading possibilities were used, exchange networks were established

or complete collections were bought. At the beginning of the 20th century, Austrian ambassadors all over the world had the order to search and collect as much as possible by the Emperor (Umlauft, 1907). Even the Imperial Navy was employed for these purposes (Anonymous, 1906).

The living plant collection together with the herbaria were part of the natural history collection. Over the centuries and until today, the Plant Collection of the Austrian Federal Gardens and the Museum of Natural History together are one of the biggest collections in continental Europe.

Fig 1_Austrian Federal Gardens



EARLY ASPECTS OF NATURE CONSERVATION

In 19th century, another important modification in the history and the attitude of collecting plants occurred in the Imperial Botanical Collections.

In previous times only a few specialists discovered unknown land and until then not described species. By the rise of the bourgeoisie as a moneyed aristocracy, a bigger demand on more and more plants came up. Gradually, professional plant nurseries developed from trading companies and plant hunters were sent out to remote and unknown regions of the world. The commercialization by establishing big plant agent companies provoked plundering of

nature. Whole valleys and regions not only in the tropics were devastated. The orchid- and bromelia fever is only one of many examples.

Early explorers and scientists on their journeys to discover and understand the world were the first to observe significant changes in the environment and the interconnection of destruction of nature and changes in local climate. Alexander Humboldt observed it repeatedly on his journey through South America (Humboldt, 1859-60).

Also the gardeners in the Botanical Collection at Schönbrunn – which Humboldt visited before he started his journey to South America (Kronfeld, 1891; Zögner, 1993) – slowly recognized that big changes were about to happen. Due to the losses in the collections, gardeners tried to get plant material back from the original collecting areas, based on travel reports and descriptions by gardeners who had visited these places only a couple of decades ago. However, the massive use of land by agriculture and growing cities often turned out, that the project of organizing new material from the original areas was unsuccessful. Gardeners started reconsidering the developments and changes that were going to happen all over the globe. Little by little, the aim of the gardeners became to keep the collections out of the own stock.

Not only scientists, but also interested citizens started understanding the context of different things happening. People learned that there are many dependencies in nature, from a small regional up to the global level. The worldwide overexploitation slowly got more and more visible. In combination with natural catastrophic events, it got more noticeable. So for example the outbrake of Tambora on Java in 1815, which had a high impact on the climate change also in Europe and led to famine and transmigration in Europe for years (Behringer, 2019).

The industrialization not only changed working processes and the way people were living. It even visibly changed the face of nature, also in Europe. In 1869, the British painter and writer John Ruskin (1819–1900) described his observation, how snow and glaciers had changed in the Alps over 35 years: „The light which once flushed those pale summits with its rose at dawn, and purple at sunset, is now umbered and faint ; the air which once inlaid the clefts of all their golden crags with azure, is now defiled with languid coils of smoke, belched from worse than volcanic fires ; their very glacier waves are ebbing, and their snows fading, as if Hell had breathed on them.“ (Ruskin, 1869, vi).

Slowly, consequences were identified by nature protection movements and first actions were set. Already from the early 19th century on people who dealt with nature (like scientists, gardeners, painters, writers, etc.) stood up for first consequences. These first movements often claimed the protection of single trees and picturesque places or sceneries. Soon, conservationists required the protection of

the last spots of wilderness (Muir, 1898). At the end of the 19th century, in the United States first national parks were put under federal protection, beginning with Yosemite in 1872 (Dilsaver, 1994). Also in the Alps changes like the loss of in earlier times very common alpine plants were observed (Benesch, 1894). With the support of Habsburgian Archdukes and newly established societies, a garden of alpine plants was built up as an in-situ collection on mountain Rax close to Vienna in 1902. At the opening ceremony in July 1903 some 600 visitors took part (Winter, 1935).

During the 19th century a major transformation process happened. The gardeners changed their attitude towards the plants and the way of acquisition. Not only the garden of alpine plants on mountain Rax, which was strongly supported by the Imperial gardeners from Belvedere, showed this change. The gardeners also wanted to find out why certain plants were easily to keep out of the stock in the greenhouses and some not at all. Whenever a plant disappeared, a new one had to be organized out of the wild.

One example to be mentioned is again the orchid. In 1899 the French botanist Noël Bernard discovered that orchid seeds need a symbiotic fungus for germinating and to be able to grow to a plant (Bernard, 1909). At the same time, Anton Hefka, a young gardener at Schönbrunn also tried to propagate orchids not by division, but by sowing. He sowed orchid seeds on different substrates. Finally, a substrate with sawdust of spruce wood succeeded. Hefka was known for his *Cattleya* and *Sarracenia* breedings, and enlarged the orchid section in the Botanical Collection at Schönbrunn in a very short time (Hefka, 1914).

At the end of the 19th century the Imperial gardeners were aware of the high value of the Botanical Collection and the situation of the flora in the wild. In 1903, Hofgartendirektor Anton Umlauft pointed out, that many *Banksia* species were endangered. “Pflicht und Aufgabe der Botaniker und Gärtner ist es, hier erhaltend einzugreifen.“ (Umlauft, 1903) [It is an obligation and a commission of botanists and gardeners to sustainably intervene.]

The knowledge of the Imperial gardeners and the long tradition in collecting attracted interest. Gardeners from Schönbrunn prepared for a collecting mission to the Cape Provinces in South Africa to find endangered plants and to transfer them to Vienna. The gardeners contacted travelers and scientists who knew the region, made a list of interesting plants, drew sketches and prepared for the expedition that never took place in reality (Anonymous, approx. 1900).

The export of endangered plants was already prohibited by local legislations. In 1908, the Austrian general consul in South Africa tried to get *Disa* species from the Table Mountain region for Schönbrunn. Though, even for the Imperial Botanical Collection in Vienna he could not get some specimens (Generalkonsul, 1908).

THE PLANT COLLECTION OF THE FEDERAL GARDENS OF AUSTRIA

In the second half of the 20th century, finally the problems of the past lead to the development of institutions, societies and regulations to secure the biodiversity, preserve endangered species, keep the rights of the country of origin and interconnect botanical collections and research institutions: UNO, CITES, Nagoya protocol, BGCI, IABG and so on.

For some time, there was a critical approach of in-situ conservation versus ex-situ collections. Nevertheless, both methods fight for the same. Especially botanical collections with a longer history have plant stocks that might have disappeared in the wild. As an example, we may name *Erica verticilata* and *Erica turgida* that came into the collection of cape plants of the Austrian Federal Gardens in the early 19th century. The plant inventory (Pflanzenverzeichnis, 1892) shows that several *Erica* species were grown without interruption in the greenhouses in Vienna, when 1999 it came out that these two species have become extinct in South Africa. After the reintroduction of these two *Erica* species, cultivated in Belvedere Garden in Vienna, in 2001 an intensive cooperation between Kirstenbosch and Belvedere started. Many other partners joined in over the years, like Bergen and Amsterdam. 2021 the Global Conservation Consortium on Erica in cooperation with BGCI got started by 13 partners.

Historic botanical collections are important genetic pools. However, you also have to consider the history of the collection and how the plants came into the collection and in which way they got collected in the original habitat. Only then, you can take over responsibility, start a process of sharing, and return of the resources with the country of origin. This can lead to a strong cooperation and a win-win-situation. The Plant Collection of the Austrian Federal Gardens has an over 450 years continuing uninterrupted tradition as historic botanic garden and collection. Today's responsibility and core-tasks written in the legal text for the Austrian Federal Gardens are: „Preservation and progression of the historical and botanical outstanding plant collections".

In detail, it can be pictured as follows:

1. Preservation of cultural heritage

The Plant Collection of the Austrian Federal Gardens is a part of the historic gardens and altogether cultural heritage and mostly part of UNESCO World Heritage Sites. The tradition that is passed on from generation to generation is the continuation and keeping special craftsmanship alive.

2. Conservation of species, varieties and sorts

The Plant Collection is an ex-situ conservation of plants and keeps a broad variety according to the main collecting

goals of the collection. Some plant-groups are cultivated in the collection already for more than 200 years, some of the plants already extinct in the wild. Historical individual plants are conserved (for example *Citrus*-, *Palm*- and *Azalea*-trees with more than 150 years of age, Palm-ferns with about 500 years, *Fockea capensis* the oldest in a pot cultivated plant of the world with about 700 years).

Fig. 2 "Encephalarthos gelinckii – Südafrika, wenn nicht schon ausgestorben" [South Africa, if not already extincted], sketch of the Hofgartendirektion, c. 1900, Austrian Federal Gardens.

3. Science and educational mandate

The cooperation with scientific institutions makes the collection available for specialist partners, societies, scientists (e.g. International plant seed exchange network). The presentation to the public (display greenhouses, exhibitions, guided tours, workshops, etc.) is an important part of our daily work.

4. Support keeping the national and international obligations of the Republic of Austria

In this connection, mention can be made of the Conservation of Biodiversity (CBD) or the

Austrian Strategy on Biodiversity 2020+. Especially the main goals in the action fields 4 and 5 correlate significantly with the core-tasks in the law.

5. Responsibility for the past and the future

The scientific work at the Plant Collection is also an ongoing process of coming to terms with the past; that means the history of the collection in general, but also with topics like colonialism and plant-acquisition in earlier times. We are taking over responsibility for the existing plant stocks and their historical development. Therefore, cooperation, sharing and restitution with the place of origin firm an important foundation – in an ideal case a cooperation can be developed out of the common past (e.g. Global Conservation Consortium on Erica)

To make a long story short: The Austrian Federal Gardens cultivate a unique Plant Collection, with an astonishing and uninterrupted history and one of the biggest collections of living plants in continental Europe.

As final point the key figures for the Plant Collection of the Austrian Federal Gardens are:

- 130.000 plants in cultivation in the greenhouses,
- 20.000 m² of cultivation area under glass,
- 17.500 species and varieties in the Plant Collection,
- 59 employees,
- 15 collection-focuses.

Apart from special exhibitions and guided tours, an overview of the Plant Collection is presented during the whole year in the Palm House at Schönbrunn.

Fig. 3 Palm house at Schönbrunn, photo I. Kanka, 2020

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THE BOTANIC GARDEN OF PISA: FROM THE INVENTION OF THE ACADEMIC BOTANIC GARDENS UNTIL TODAY

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Abstract

The rise of academic botanic gardens took place in Italy during the Renaissance, in the middle of 16th century: the first academic botanic garden was founded in 1543 in Pisa by Luca Ghini. Nowadays, the Botanic Garden of Pisa has a variegated spectrum of activities, in line with the definition of a botanic garden provided by the Botanic Garden Conservation International. Originally built on the banks of the river Arno, the Garden was moved to the current site in 1591 and then gradually expanded up to ca. 25,000 m^2. It is currently divided in seven sectors, hosting about 2,000 taxa arranged across 29 thematic collections.

The documentation of plant material is performed through an *ad hoc* developed software platform (*U-Plant*), from which the staff also coordinates the labelling activities of plants. A freely accessible online platform (*U-plant DISCOVER*), providing the exact position of specimens in the garden and other primary data, is currently in course of publication.

The Botanic Garden supports research activities of several Departments of Pisa University, and especially of the Department of Biology. The major focuses of the researches involving the support of the Botanic Garden are: (a) taxonomy and systematics, (b) phytochemistry, (c) reproductive biology, (d) conservation, and (e) plant ecology. The conservation of plant diversity is an issue of particular interest for the Garden. The *ex-situ* management of threatened species is achieved both through direct cultivation and seeds storing in a Germplasm Bank located in the garden. The Garden supported a translocation project of two species of national conservation interest in 2014-2015, namely *Hypericum elodes* L. and *Symphytum tanaicense* Steven.

The average number of visitors of the Botanic Garden and Museum of Pisa per year is ca. 60,000. The spectrum of educational activities ranges from nursery school up to university; in 2019 (the most recent pre-Covid year), didactic activities were offered to 248 mandatory schools' classes, involving thousands of students. Additional educational activities are periodically organised, such as seminars, courses or citizen science events. In general terms, the Botanic Garden allows only events aiming to contribute to the transmission of botany, thus excluding the use of its spaces as simple location of events such as concerts, readings, markets (even if related to horticulture). The Botanic Garden and Museum of Pisa has three social accounts: Facebook (@OrtoBotUnipi, > 8.5K followers), Instagram (@ortobotanicopisa, > 3.5K followers), and Twitter (@Orto_unipi, 136 followers). In recent years the Garden is increasing the attention towards the improvement of its social role. As example, we implemented personalised inclusive experiences for people affected by autism spectrum disorder, video-guides in LIS (Italian Sign Language), and projects of social rehabilitation for inmates through gardening activities.

NATURAL HERITAGE OF LISBON BOTANIC GARDENS: AN INTEGRATIVE CONSERVATION APPROACH WITH UNIQUE TREE COLLECTIONS

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Botanic gardens have a long history of contributions to plant science and have played a leading role in the development of fields such as ex-situ Conservation, Botany or Garden Art History. The University of Lisbon holds a rich natural and historical heritage that serves as a valuable scientific resource, three botanical gardens – Botanical Garden of Ajuda (JBA), Lisbon Botanical Garden (JBL), and Tropical Botanical Garden (JBT). Lisbon city has three very different gardens, created in three different times but with overall purposes: research, plant conservation, horticulture, and education. It is essential to know this heritage and all that it represents. The study of these gardens and their collections provide an indispensable source of knowledge in Garden Art History and Biodiversity knowledge. We aimed to contribute to disseminate the heritage represented by the botanical gardens of Lisbon, by coupling the history and the characteristics of the tree layer that dominates them. With this approach, we intended to explain why the presence of three botanical gardens in Lisbon is not redundant and to highlight their continued relevance for knowledge and for urban sustainability. Our results showed that the tree layers of the three Lisbon's Botanical Gardens contain a total of 2546 specimens, corresponding to 462 taxa of trees. Of these, 85 taxa are found in the three gardens, and more than half of the taxa are hosted in JBL (334 taxa), whereas 230 and 201 taxa were recorded in JBT and JBA, respectively. The motivations for the creation of each garden are reflected on the different geographic origins of the taxa they host. The Palearctic

species are dominant in JBA and JBL, and tropical tree taxa prevail in JBT, which holds a large number of Neotropical, Eastern and Afrotropical species. This study contributes to reveal the historical and natural heritage of Lisbon's Botanical Gardens, improving its role as a living museum. Also, it constitutes a tool to protect and enhance the botanical gardens and their botanical assessment in order to protect and promote this legacy as cultural heritage with high ecological, recreational, artistic, aesthetic, social and tourism value.

Key-words: Conservation; historical heritage; living trees collections; Portugal; spermatophytes; trees; urban green spaces.

HISTORICAL GARDENS OF LOUSADA

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Abstract

The Municipality of Lousada, located in the peri-urban territory of Greater Porto, faces increasingly unrelenting anthropogenic pressures. The incessant pace of urbanization, agricultural and forestry intensification, and various public and private enterprises add challenges to the already complex task of making economic development compatible with quality of life, which necessarily depends on environmental quality.

Thus, in a deep commitment to improving the municipality's environmental condition, the municipality assumed in 2015 a transformative Municipal Strategy for Sustainability.
Based on scientific knowledge, this Strategy sought the most diverse means to promote environmental literacy and education, worked to protect biodiversity and cemented fundamental partnerships with the most varied public and private agents in the territory, in order to accelerate the process of change but, more importantly, ensuring its acceptance and ownership by the community.

The first works of ecological characterization of the county made it possible to discover its rich biodiversity, but also to establish priorities for intervention. It was immediately possible to see that the old manor houses, with the gardens, outbuildings and forest areas

that are usually associated with them, constitute small "oases" of biodiversity. Clearly deserving a closer look, and from the perspective of the various sciences that study and dignify our heritage – biology and botany, archeology, and history, among others – the 'Lousada Jardins' project started in 2018.

This project aimed to discover and characterize all the floristic, cultural, archeological and architectural heritage associated with the historic gardens of the manor houses in Lousada, as a starting point for their enhancement, promotion and conservation.

The value of historic gardens is not limited to the material and biological heritage they comprise; it also has enormous pedagogical and awareness-raising potential. The historic gardens are authentic open-air museums, ethnographic repositories, records of a time that shaped local history. They combine, in a restricted area, the biological representation of various parts of the world, as was seen in this work. In the more than 50 historic gardens in Lousada, 192 species of trees and shrubs have been identified, and many more are found in the forest and other adjacent areas.

The characterization work resulted in the publication of a Guide where 136 species of trees and shrubs present in 25 manor houses in the county were compiled, whose gardens are of a size and conservation status in line with group visitation.

In the second part of the guide, the files of the botanical species were organized, in order to help visitors in identifying the trees and shrubs.

Routes for visiting the gardens were also proposed.

The Guide and the Visitation Routes are a humble tribute to the heritage of excellence that the Manor Houses and Gardens contain and are important steps towards the characterization and promotion of this heritage of excellence.

FROM THE ROYAL GARDEN OF MEDICINAL PLANTS TO THE CURRENT BOTANIC GARDENS AND RESEARCH DEPARTMENTS, A LONGSTANDING TRADITION FOR MEETING SOCIETAL NEEDS

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Abstract

Situated at the crossroads of Earth, Man and Life sciences, the Museum National d'Histoire Naturelle, (the Museum), is a unique national institution with a 400 years rich history, a diversity of missions and domain of research and impressive naturalist and documentary collections. The first vocation of the Museum was botanical and the discipline remains central to its activity. The Royal Garden of medicinal plants, which later became the Jardin des Plantes, has never ceased to be a place dedicated to the study, conservation, monitoring and awareness raising of the Earth botanica diversity.

Today, thanks to the actions deployed in its 4 botanic gardens, in the departments dedicated to the study of living, herbarium and ethnobotanical specimens, to the monitoring and conservation of the regional plant diversity and to its implication in capacity building initiatives and its involvement in national and international networks, the institution is actively involved in contributing to the 5 themes and the 16 targets of the Global Strategy for Plant Conservation, GSPC.

This presentation will highlight some of the key programs and action developed in each of the five themes of the GSPC:

- Plant diversity is well understood, documented, and recognized
- Plant diversity is urgently and effectively conserved
- Plant diversity is used in a sustainable and equitable manner
- Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on Earth is promoted
- The capacities and public engagement necessary to implement the strategy have been developed.

In all its fields of expertise, the Museum is fully committed to tackling the 21st century challenges and responding to the current societal needs. It is also demonstrating that nearly 400 years of existence have not weakened its implication in the study, the teaching, and conservation of Plant and Fungi diversity. It is particularly engaged in contributing to the implementation of the Global Strategy for Plant Conservation and its European application, the European Strategy for Plant Conservation.

EFFORTS TO CONSERVE RARE, ENDANGERED AND ECONOMICALLY USEFUL MEDICINAL PLANTS OF WESTERN GHATS OF INDIA

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ABSTRACT

The Western Ghats of India is among the ecologically richest regions and one of the major repositories of tropical medicinal plants. It can be noted that the plants that were very common in the area when they were first studied have got into the IUCN Red List over the years.There is an urgent need to develop efficient *ex situ* conservation strategies for these species to prevent further genetic erosion. In the present study, six endangered medicinal plants viz. *Holostemma-ada-kodien, , Gloriosa superba, , Salacia reticulate, Tinospora* and *Decalepis hamiltonii* were explored, collected and conserved for sustainable utilization. The species are selected considering its status in terms of threat, use in traditional medicine and demand in the pharmaceutical industry. A total of thirty three plants with a maximum of fifteen in *Gloriosa superba*, eight in, four each in *Holostemma-ada-kodien* and *Salacia reticulata* and two in *Tinospora sinensis* were collected and their growth parameters were recorded. Medicinal plants collected and conserved in the Field Gene Bank were characterized using species specific descriptors.Based on the observations, data base was generated for documentation. The propagation studies for all the collected species have been undertaken and seed and vegetative propagation methods were standardized. The results of the experiment are found to be useful for further multiplication and conservation of these medicinal plants for their sustainable use. Education programmes on conservation of medicinal plants were organized for students and general public to foster ecological responsibility and to encourage joyful interaction with the natural world.

KEY WORDS: Biodiversity, distribution, documentation, propagation and education

INTRODUCTION:

The rapid loss of biodiversity globally and especially in developing countries has become the subject of increasing national and international concern. This is evidenced in the substantial increase in the interest accorded to biodiversity by governments and financial aid by donors and conservation organizations. Human activities are rapidly reducing the planet's life supporting capacity. The ever-increasing human population places heavy demand on the bioresources. The impact and pressure on the nature is quite conspicuous and the onus is seen on the forest resources with depletion of biological diversity, which has become a sever ecological problem (Soul, 1991). Forests are the cradles of biodiversity and are one of the most important renewable nature resources. Biodiversity is termed as the 'species richness' in a habitat in a given time and is critical to the health and

stability of the biosphere and renewability of the biomass, soil and other related aspects. The over exploitation of the resources and deforest action brought about by indiscriminate logging in the tropical forests has resulted in depletion of biodiversity and the serious situation may worsen in due course if left unchecked. The main threat to tropical biodiversity's habitat loss (Bowels *et al,* 1998).

EX-SITU CONSERVATION AND DOMESTICATION OF RET MEDICINAL PLANTS

It is very much essential to develop *ex-situ* gene bank of the RET species which are becoming extinct and also to addition, domestication of these important medicinal plants and their cultivation for sustainable utilization will go a long way for the benefit of mankind. India is one of the twelve mega biodiversity countries of the World, harbours 45,000 described plant species of which 15,000 to 20,000 possess proves medicinal value. Out of 900 major medicinal plants available in India, about 10% is highly threatened due to various reasons. In India, the unsustainable collection of medicinal plants from the wild for commercial purpose and habitat destruction due to urbanization stand high among the human induced causes of depletion of medicinal plant population.

Quantitative assessment of the status and distribution of medicinal plants is indispensable for proper management of the plant resources. The lack of authentic information on the status and distribution leads to various kinds of inconveniences including mismanagement of medicinal plant wealth. At the same time, identification of genetic variations of medicinal plant species and their mass multiplication and conservation have become an important task in the sustainable and equitable use of the enormous and invaluable genetic diversity found in the country (Wilcove, 1989).

Keeping these values in focus, Department of plantation, Spices, Medicinal and Aromatic Crops, University of Agricultural and Horticultural research Station, Shivamogga, India undertaken such an endeavor in the Western Ghats of India. Our focus is mainly exploration, collection and *ex-situ* conservation of five RET medicinal plants. The specific objectives of our program are:

1. To explore the status and distribution of five RET medicinal plants in Western Ghats of India
2. To collect and conserve all the possible variants of target species *ex-situ* in the conservatory.
3. To document the information related to the target species and location and develop a data base

MATERIALS AND METHODS

The following RET Medicinal plants were chosen for the exploration and conservation.

1. *Decalepis hamiltonii*
2. *Gloriosa superba*
3. *Holostemma ada-kodian*
4. *Salacia reticulata*
5. *Tinospora sinensis*

I. *Decalepis hamiltonii* Wight & Arn.

Family: *Asclepiadaceae*
Common name: Mahali kizhangu
Threat status: Endangered
Used in: Ayurveda, Folk and Sidha

Common uses: The roots of makali beru are used in the form of powder and infusion to treat wound an bronchial asthma. The tuberous roots are used as cooling agent and blood purifier.
Habitat: In open rocky slopes and rocky cervices of dry to moist deciduous place/forests

II. *Gloriosa superba* L.
Family: *Liliaceae*
Common name: Kalapai kilangu
Threat status: Endangered
Used in: Ayurvedha, Sidha
Common uses: The tuberous roots are useful in curing inflammations, ulcers, bleeding piles, skin diseases, snake bite, baldness etc.
Habitat - Sea-level to semi evergreen forests.

III. *Holostemma ada-kodien* Schult.
Family: *Asclepiadaceae*
Common name: Palaikkirai
Threat status: Vulnerable/ Regional
Used in: Ayurveda and Folk
Common uses: The roots and leaves are used in the form of powder and juice to treat spider poisoning, fever with burning.
Habitat: Dry and moist deciduous forest.

IV. *Salacia reticulata* Wight
Family: *Celastraceae*
Common name: Ponkoranthi or Kadal Azhinchal
Threat status: Rare
Used in: Ayurvedha, Folk and Siddha
Common uses: Roots are used in diabetes, hemorrhoids, leucorrhea, leprosy, skin diseases, wounds, ulcers and liver disorders.
Habitat: In open marshy forests of Coastal regions.

V. *Tinospora sinensis* (Lour). Merr.
Family: Menispermaceae
Common name: Chintil kodi
Threat status: Vulnarable
Used in: Ayurveda and Folk medicine
Common uses: Dried stem are used in fever, jaundice, thirst, burning sensation, diabetes, piles, skin ailments and respiratory disorders. It also improves intellect and impart youthfulness, vitality and longevity.
Habitat: Ever green moist deciduous forests.

RESULTS AND DISCUSSION

The field of plant conservation includes the study of plant decline and its causes, techniques to conserve rare and endangered plants. Medicinal plant conservation can be considered a part of conservation biology, a relatively young field that emphasizes the conservation of medicinal plant biodiversity and whole ecosystems, as opposed to the conservation of individual species. In the present study focus was given mainly to five important RET medicinal plants of greater values.

I. Decalepis hamiltonii

This medicinal plant, which is commonly known as Makali beru in Kannada was found in wild in the moderate hill ranges of Savanadurga, Agumbe and Charmadi, in three different locations of Karnataka in India besides some other places of South India.

1	Collection	1. Savanadurga	2. Agumbe	3. Charmadi
2	Latitude	$11^0$22’54.56”N	$12^0$07’52.31”	$10^0$07’43.42”
3	Longitude	$78^0$41’11.68”E	$77^0$53’52.31”	$78^0$05’06.58”
4	Elevation	682’	1653’	1604’

5	Collection	Wild	Wild	Wild
6	Populatio	4	6	2
7	Samples	Endangered	Threatened	Threatened
8.	Types of sample	Fruits/Individual plant	Individual plant	Individual plant

Biometric Observations:

The RET medicinal plant, Jivanti is a threatened sp. In the Charmadi hill ranges, in which four populations were found beneath the lemon grass patches. In every summer when the forest fire occurs and engulfs the dry lemon grasses, *Holostemma* will also get destroyed. Fortunately, because of the tuberous roots in the soil, they sprout again during the South – West monsoon in the months of May – June.

AccessionNo	Vine	Vine	Leaf
DH-1	187	2.05	50.4
DH-2	190	1.83	56.1
DH-3	170	1.62	62.6
DH-4	151	1.43	35.5
DH-5	203	1.63	37.5
DH-6	221	1.02	37.2

Based on the leaf area, we could identify two distinctive variations among the accessions. The seeds collected from the pods were dried and sown in seed trays and it took 42 days for germination. The hardened three months old seedlings were planted in the field where they have put forth new flushes. We could also notice the tuberization of their roots within four months of planting.

II. Gloriosa superba

During the exploration of the Agumbe reserve forest of swampy areas, normally spread tubers of 2 population were collected and planted in the field for observations. Another three populations were collected from Sirsi reserve forest and planted in the field for observations.

III. *Holostemma ada-kodian*

Accession No.	Vine Length(cm)	Vine girth(cm)	Leaf area(sq.cm)	Days to flowering
HA-1	263.0	1.26	48.6	68
HA-2	162.0	1.42	46.4	70
HA-3	242.0	1.84	68.2	62
HA-4	249.0	1.86	70.4	64

Among the four populations, HA-3 was early to flower in 62 days and the number of flowers was also high.

IV. Salacia reticulata

During the exploration of Sirsi reserve forest of the East Coast region, four populations of *S.reticulata* were located and their plants were collected as root suckers. Another sp. known as *Salacia chinensis* was found in the Kollur reserve forest. Eight seedlings of this species were collected and planted in the field gene bank.

V. Tinospora sinensis

The wild species of it which is commonly known as cinthil kodi has been located in the Subramanya forest. Two populations

were identified and their stem cuttings were put in the Mist chamber for multiplication and conservation. Further emphasis has been given for their large-scale multiplication and to study their adoption for ex-situ conservation in the field gene bank in our herbal garden

CONCLUSION

Conservation of medicinal plants in its biocultural perspective not only implies conservation of biodiversity but also places an equal emphasis on conservation of cultural diversity. The debilitating ecological consequences of monoculture in biological life are well known. The effects of promoting a monoculture in the civilizational context are only now being recognized. Hence, we have to give emphasis for the conservation of RET medicinal plants.

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THE COPY OF THE HISTORICAL ORCHID COLLECTION THAT KING LUIS I CREATED 1881 IS RECREATED

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Abstract:

Luis I, the king of Portugal created an orchid collection for the Botanic Garden of Ajuda. The collection can be considered as ready as 1881. There is a list of plants showing names of 438 different orchid species including a few hybrids. At that time there were also about 250 other orchid species in the Garden. These had not yet shown any flowers, so the director was waiting to define the names. So, the total amount of different orchids was about 680.

An estimate of the value of Ajuda's orchid collection can be made by comparing this number (680) to the number of orchid species and variations in the leading manual for orchid growers. In the edition from 1877 it had 930 orchids described. So Ajuda had about 70% of the best-known orchids at that time.

The orchid house that was made for this orchid collection has been considered as modern and technically high-quality. It was described as such in the known article in a portuguese horticultural journal.

The real quality was described in the annual report of Luiz de Mello Breyner, the director of the Garden 1881. He was clearly sad because he had lost a special collection of 25 Masdevallia spp. because he had only primitive greenhouses to grow the orchids.

The orchid collection lived at different times up to 1940. Then it disappeared, so that there was practically nothing left in 1970.

We decided in 2015 to recollect all those orchid species and open it to the public. Now the hard work has been done. We can show almost all those species and we have tested in a pilot orchid house the proper growing conditions for them.

TAPADA DA AJUDA BOTANICAL PARK: A HOTSPOT OF PLANT DIVERSITY IN THE HEART OF LISBON

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Abstract

Tapada da Ajuda Botanical Park is located in Instituto Superior de Agronomia (ISA), between the Parque Florestal de Monsanto and Alcântara. This space is a botanical area with 100 hectares, and has a great botanical value, with several wild species characteristic from the native vegetation of Lisbon. The Tapada da Ajuda has its origins in the “Real Tapada da Ajuda” dating back from 17th century. In 1841, natural woods mainly of wild olive trees (Olea europaea L. var. sylvestris (Mill.) Lehr) were cultivated. In 1910, the Instituto Superior de Agronomia (ISA) was created, and since then Tapada da Ajuda has been dedicated to research in the field of agronomy and to support teaching and studying botanical diversity. Within the Tapada da Ajuda, we can find a natural botanical reserve, which has an area of approximately 4.5 hectares and owns an enormous natural value. In 1951 it was named as “The Nature Botanical Reserve D. António Xavier Pereira Coutinho”, by ISA's School Council of that time, during the celebration of the centenary of the Coutinho birth. The great botanical diversity of the Tapada da Ajuda is only possible due to its size, as well as, the various edaphic and

climatic conditions it offers, allowing the acclimatization of plants from different biogeographical areas, of which about 550 taxa are trees and ca. 2500 are shrubs or perennial herbaceous. This communication presents the tools that have been implemented recently to contribute to the conservation, improvement and dissemination of the unique floristic patrimony of Tapada da Ajuda Botanical Park, namely: a) the geographical database of PBTA plant species; b) the characterization sheets for the botanical species of PBTA (available at http://www.isa.ulisboa.pt/pbta/colecao-botanica); and c) the identification plates of the PBTA species. With almost 400 years of existence, Tapada da Ajuda Botanical Park has a vast natural patrimony, landscape, architectural and cultural heritage. This area presents a hotspot of diversity within the city of Lisbon and hosts some taxa that were classified in threatened categories, playing an important role in their preservation.

Keywords: Biodiversity, Conservation, Botanical Park, Flora, Botanical Collections, ex-situ Conservation.

REVITALIZATION OF THE HISTORICAL PLANT GEOGRAPHICAL DIVISION AT THE BOTANICAL GARDEN OF THE UNIVERSITY OF VIENNA

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ABSTRACT

The Botanical Garden of the University of Vienna was founded in 1754. Under the directorship of Anton Kerner von Marilaun, “plant geographical” display areas were established in 1879; this seems to be the first division explicitly dedicated to plant geography in a Botanic Garden worldwide. After an enlargement in 1889 the “Pflanzengeographischen Gruppen” comprised c. 25 different geographical areas with typical elements of their vegetation zones. The historical arrangement of these groups and the original plantings are well documented in publications, maps and by photos. During World War II, the division was substantially damaged. In the 1970s, parts of the area were converted into research cultivation spaces. The remaining area was only

managed at a minimum. Since the mid-1990s a new concept for revitalization of this part of the Botanical Garden was initiated, based on the historical evidence, but incorporating new scientific concepts as well. Using the remaining woody plants as backbone, the revitalization was started with herbaceous plants of known wild origin fitting to the original geographical groups, and now includes woody species as well.
Criteria for selecting new taxa to be planted are, i.a., representativeness for the geographical area, endemic species, or species/genera not yet cultivated at the Botanical Garden. Anticipating potential effects of climate change, the selection of new species also takes hardiness aspects into account. Especially species reported "just not to be hardy in the Viennese climate" are tested. This approach, which is favored by the fact that the area is not accessible for the public and is surrounded by buildings from three sides, is likely to enlarge the number of species from different geographical regions of the world and also to provide long term information about the climate resistance of the selected species.

KEYWORDS
Historical plant displays, plant geography, climate change, winter hardiness

INTRODUCTION

The foundation of the Botanical Garden of the University of Vienna has been initiated in 1754 by empress Maria Theresia, based on a recommendation of her personal physician Gerhard van Swieten. At that time, the garden was situated far outside the city centre and covered only a small percentage of the current area.

Today, the garden has a size of about eight hectares. Quite a unique feature is the fact that the garden never had to move, and, as the city has grown, it is today placed close to the city centre.

In the early days of the garden, visits to and studies at the garden with its medicinal plants were part of the education of physicians. Thus, a division of useful plants has a long tradition in the garden; it is located at the very same place since 1883 (figure 1).

Already soon after its foundation, plant systematics developed to a core topic for the garden. This is reflected by changes in the garden layout especially during the directorships of Stefan Endlicher (1839-1849), Eduard Fenzl (1849-1878), Kerner von Marilaun (1878-1898) and Richard von Wettstein (1899-1931) (KIEHN 2004, KNICKMANN et al. 2020). Glasshouses were built in the 1880s, the core of the current buildings is dating back to that time. An arboretum was developed along with other parts of the garden at that time. Based on research interest by Anton Kerner von Marilaun, a plant geographical division has been established in 1879, being the first of its kind at least in Europe. Today, this division covers an area of about 5000 square meters. Plant geography was still a very young branch of science, mainly inspired by the experiences, scientific conclusions and deductions of Alexander von Humboldt after his

journey through South America. A Flora of Austria display group exists in its modern form since 1990. In former days, in that part of the garden a collection of plants from the Austrian empire was situated.

MATERIAL AND METHODS: ANALYSIS OF HISTORICAL DOCUMENTS AND OF RECENT STUDIES RELATED TO THE PLANT GEOGRAPHICAL DIVISION

To understand the historical concept and layout and to develop a modern concept of the geographical display group, historical documents have been analysed. The oldest existing map with a description of the area is dating back to 1882 (figure 2). A second map from 1890 is more detailed and better readable as regards layout and structure of the division including the explanations (figure 3). In the part with Chinese and Japanese plants the so-called famous "Jacquin-Ginkgo" already had a considerable size (figure 4). Most remarkably the tropics had been included, for example water plants from the Nile or tropical orchids. This concept went hand in hand with the building of the glasshouses.

There are several photographs, presumably dated around 1886. Those are the most reliable documents. According to the historical photographs, the structure within the display group was quite detailed. For example, the Mediterranean flora was divided in different sub-areas like the „liburnischer Gau", an old-fashioned German expression which corresponds today more or less to the Croatian coastline (figure 5).

Plant lists for the area exist from different years. They are hard to interpret, as one cannot always be sure whether all the plants on these lists have been really planted. But they at least are helpful to understand the concept. The latest "historical" plant list of the plant geographical display group dates back to 1950. This is proving that the division has not been given up at that time, in spite of tremendous damages caused by World War II. The garden had been hit by many bombs that left behind craters, documented in the so-called Bombentrichterplan ("map of bomb craters") of the systematic division. The adjacent division of plant geography must have been hit in the same way. All over the garden, more than 200 trees had been uprooted (KIEHN & PETZ-GRABENBAUER 2004).

Thus, for about 70 years plant geography had been a very elaborate topic in the garden and the plant geographical division had been an intensely maintained area. Between the 1970s and the 1990s, however, the division was abandoned and more and more left on its own. The ideas for a revitalization started in the 1990s. In 1993, a very detailed survey provided data of what had survived until then (SCHULER unpubl.). In 2013, a diploma thesis presented another survey and a concept for the revitalization of the group (AMELIN 2013).

DISCUSSION: CHALLENGES AND CHANCES FOR THE REVITALIZATION

A couple of challenges have to be tackled to secure a meaningful revitalization of the former plant geographical division. For example, parts of the area are presently used for other purposes (e.g., as compost heap, research cultivation spaces, or parking lot.) Some spontaneous "invaders" have established populations, e.g. *Fallopia japonica* Such taxa need to be thoroughly eliminated before replanting the area. The area had no maintenance of the old trees for many years, so there is a need to catch up with safety matters.

The area is not accessible for the public. There is no longer a connection with the main garden area. This might be seen as a pro or a contra for the revitalization-plans.

The layout of the pathways within the group needs a reassessment as well. The management of pathways is getting more demanding, especially to keep them clear from weeds. Constructing new pathways underneath old trees is a challenge of its own.

In general, talking about historical botanic gardens is talking about old trees. They are the witnesses of old ideas and concepts, and they are habitats. In the inventory of the plant geographical division, there are two precious specimens of outstanding scientific value: one is the living type of *Quercus veneris*, nowadays classified as a subspecies of *Quercus infectoria*. The other one is the old "Jacquin-Ginkgo" on which a famous pruning experiment (pruning a female branch on the male tree) had been carried out (figure 4).

These old trees are the starting point for new ideas and concepts, and the revitalization has to start with decisions about every single one of these specimens. After that, and after deciding about the core topics of the new concept, new woody plants and then the herbaceous species can be added.

According to the mentioned diploma thesis (AMELIN 2013) there is enough support from the backbone trees for the revitalization of three main areas with plants from Asia, North-America and Europe to Middle East.

But a new concept should be a widened one. The revitalization shall be connected with the new challenge "climate change". The area is well suited to turn it into a trial area for hardiness of plants in Vienna. Vienna is situated in the hardiness zone 8a, so the future selection of plants should consider zone 8b to 9 as well. Moreover, the effects of climate change affect not only winter hardiness. Droughts in summer already caused losses in the collection like the *Sequoiadendron giganteum*. There is a need to try out tough plants that can face such diverse, new and not yet foreseeable conditions. This can be done in the group in a plant geographical context. *Viburnum henryi* from Central and South China, and *Cyclobalanoposis glauca*, originating from the Taiwanese mountains, are two such candidates ready to be planted out and worth a try. The new set of plants

might be quite different from the one originally found, but shall focus on endemic species of the displayed geographical entities as well.

In case the area will be reopened to the public, there would be two added values: there is a big potential of creating aesthetically appealing plantings and there is the possibility of including a whole range of plants from the glasshouses visitors would never see otherwise.

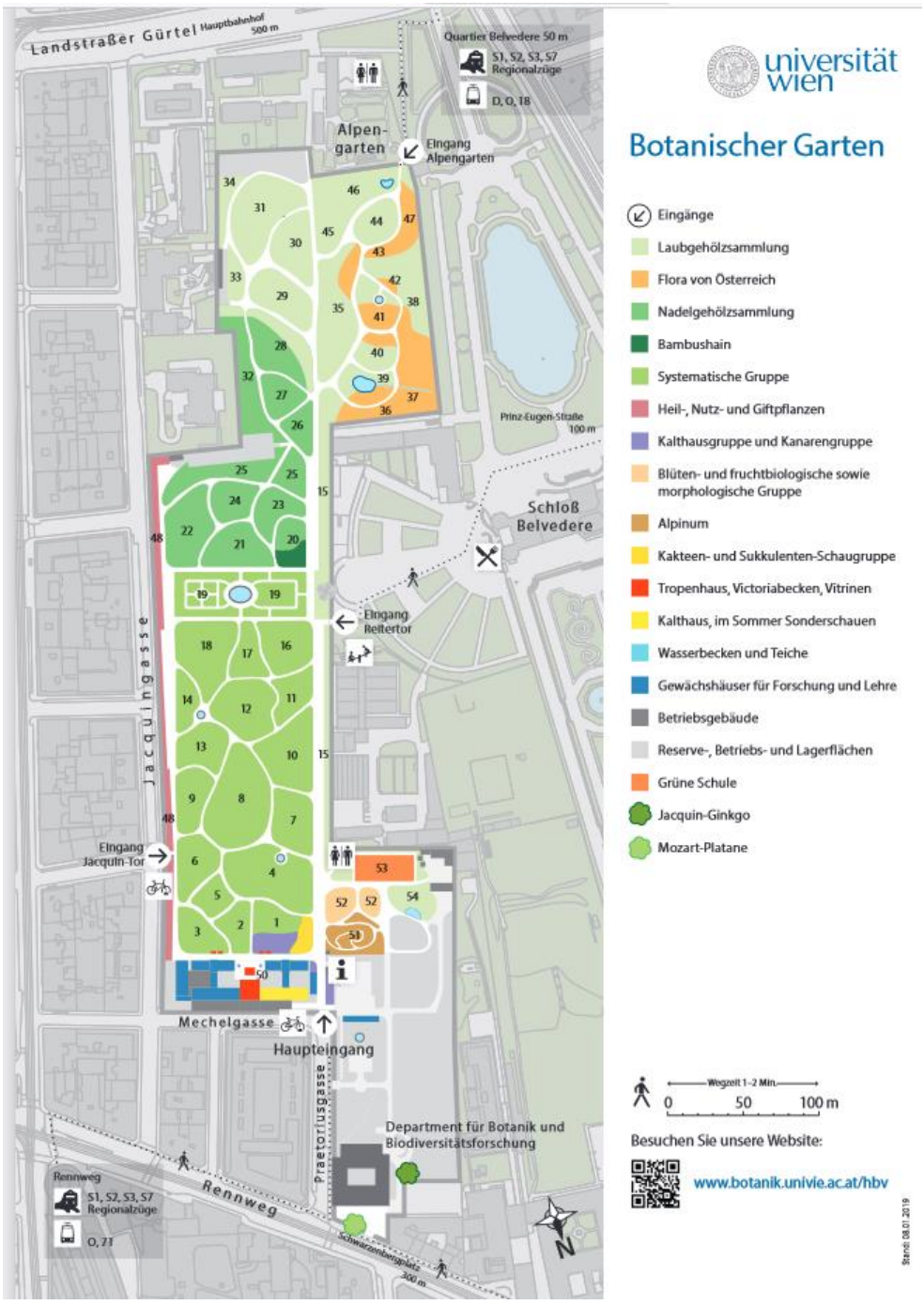

Figure 1: Current map of the Botanical Garden. The former plant geographical division is situated in the bottom right corner (part of the grey coloured area)

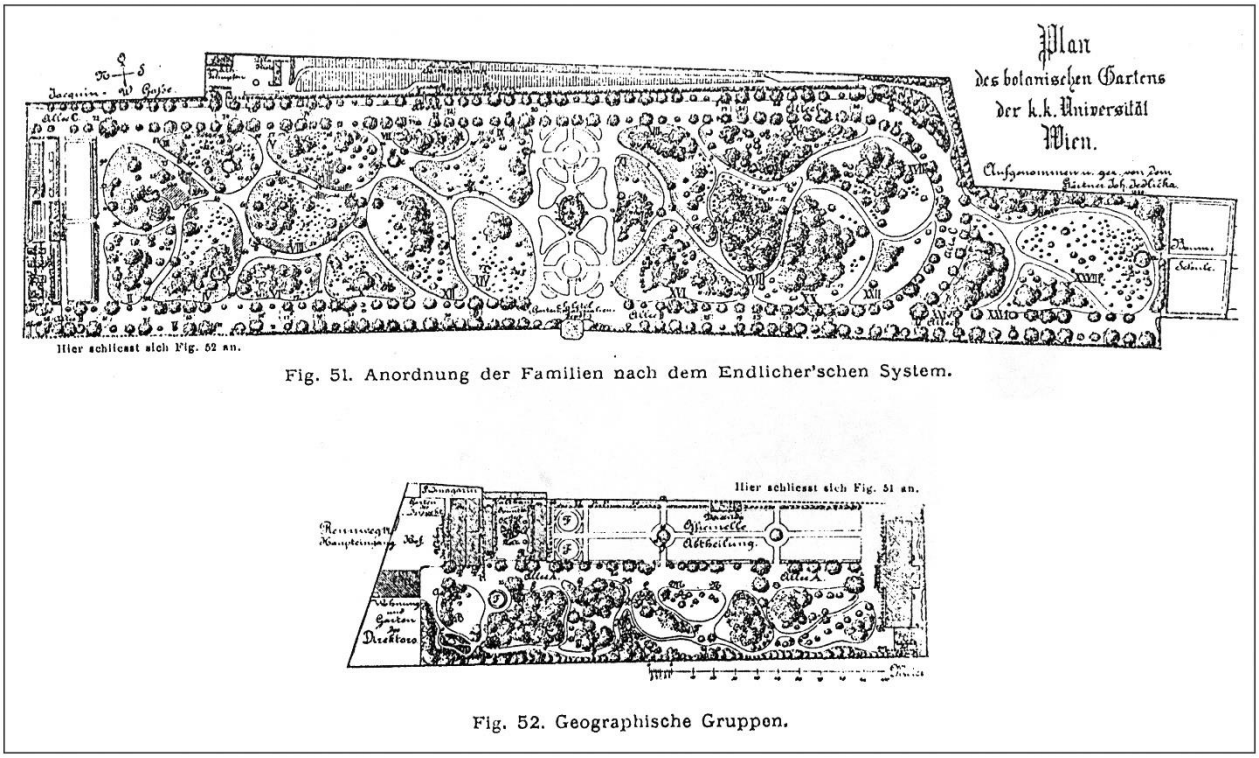

Figure 2: Garden map of 1882 including the first illustration of the plant geographical division

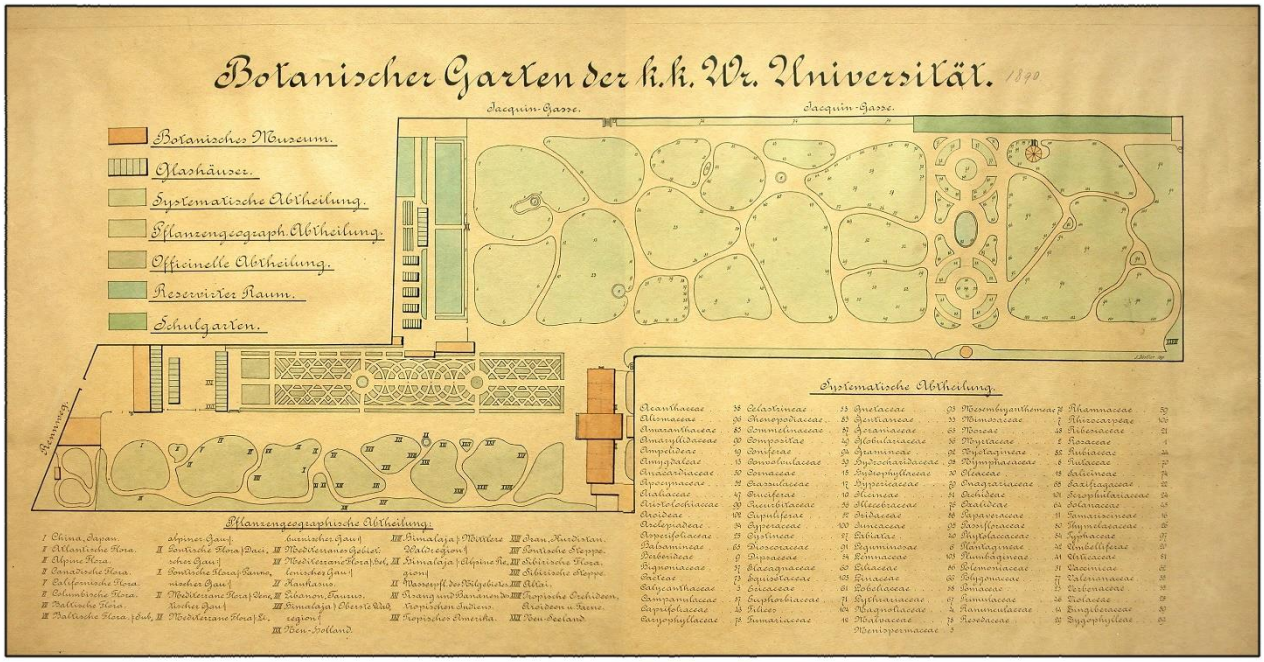

Figure 3: Garden map of 1890 with most detailed legend of the plant geographical division

Figure 4: Photograph of the famous “Jacquin-Ginkgo” with a female branch pruned at the lower part, c. 1886

Figure 5: Photograph of the “Liburnischer Gau” within the Mediterranean section of the former plant geographical division, c. 1886

CONCLUSION

The Botanical Garden of the University of Vienna had a thoroughly planned, designed and well maintained plant geographical division for more than 70 years. There is space, enough evidence and there are scientifically precious specimens for a new start at the original site. The concept should be widened by adding new species „fit for climate change“, arranged according to plant geography. The success of this new start depends at a high degree on capacities in terms of man- or women power in the planning period, and on capacities concerning the implementation of the concept. Once established, also maintenance must be ensured.

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RESTORATION OF LA ROSALEDA, REAL JARDÍN BOTÁNICO-CSIC (MADRID, ESPAÑA)

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ABSTRACT: We report here the actions undertaken to restore the Rose Garden ("La Rosaleda") at the Real Jardín Botánico-CSIC, sponsored by CHANEL-Spain. The garden, occupying c. 3 hectares, brings together more than 340 specimens from different species, varieties and hybrids, from ancient roses grown for ornament in the XIX century to modern varieties linked to the cosmetic industry. Restoration involved soil conditioning, relocating and planting new varieties, and installing a new irrigation system by the Garden staff, as well as the design of information panels and a communication campaign by RJB Scientific Culture Units.

KEYWORDS: irrigation system, Gardening School, mulching, Rose Garden, sponsorship

INTRODUCTION

The Real Jardín Botánico (RJB) of the Spanish National Research Council (Consejo Superior de Investigaciones Científicas, CSIC) was created in 1755 by order of Fernando VI in the Huerto de Migas Calientes, on the outskirts of Madrid. In 1774 Carlos III ordered its transfer to the present location in the Paseo del Prado (Armada et al. 2005).

The Rose Garden ("La Rosaleda") of the RJB-CSIC is a unique space of about 2,800 m^2, located in the four central squares of the lower terrace at the RJB, close to Paseo del Prado and next to the Puerta del Rey, on either side at the beginning of the grove Paseo de Carlos III (Fig. 1).

Today, the cultivation of roses in the Royal Botanical Garden has a purely ornamental function, but at the beginning of the 19th century the roses that were grown here were used to produce perfumes for the royal palace.

The rose collection brings together more than 340 specimens of different

species, varieties and hybrids, coming mainly from the rose bushes collection donated in 1977 by Mrs. Blanca de Urquijo (1924-1997), the exchange with the Parque del Oeste rose garden (Madrid), and a collection of wild roses from the Iberian Peninsula created with the support of the municipal government of Madrid. With the passage of time, the soil has become depleted, and the irrigation system deteriorated, with many emitters clogged or broken, as well as poorly located.

In this paper, we describe the different actions carried out by the students and teachers of the School of Gardening under the supervision of the Gardening and Arboriculture Unit to the restoration of the Rose Garden of the RJB-CSIC; but also the actions undertaken together with the units of Culture and Education and Communication and Scientific Dissemination.

MATHERIAL AND METHODS

Gardening and Arboriculture Unit, and Gardening School

Restoration activities were carried out in the four squares (C7-C10) that constitute the Rose Garden (Fig. 1). Before soil improvement, the rose bushes were previously pruned during winter. Then, gardeners undertook actions to improve and conditioning the underground and aerial parts of the rose bushes. Finally, several some specimens were relocated, and new specimens of rose varieties from the 18th and 19th centuries planted to complete and enrich the existing collection.

All actions undertaken are summarized below in the order they were executed:

1.- Soil renewal with a 50% mix of earthworm humus and sand (Fig. 2a,b).

2.- Relocation of several specimens to constitute natural groups (Fig. 2c,d).

3. Installation of a water permeable mesh (140 g/m2, Fig. 2d) to prevent the grass growth, and application of a UV treatment to control weeds.

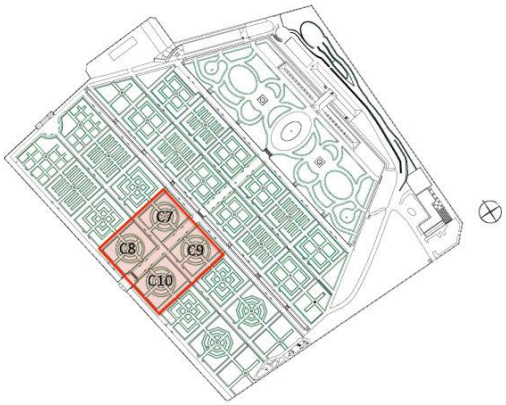

Figure 1: Map of the Real Jardín Botánico, indicating the location of the four squares (C7-C10) that make up the Rose Garden ("La Rosaleda").

4.- Application of crushed bark mulch of various tree species (Fig. 2e).

5.- Plantation of new specimen to increase the representation of oldest and best-scented rose varieties (Fig. 3a,b). Twenty-two new classic rose bushes were planted, increasing the value of the collection, such as *Rosa phoenicia* Boiss., predecessor of the Damask, Alba, Centifolia and Muscosa roses; Damask rose or 'Summer

Damask', and hybrid *Rosa* x *damascena*; the 'Old Blush'; one of the Chinese roses imported in the 18th century that conferred to the ancient European roses the long-awaited repeated flowering.

6.- The walking trails were improved with compacted gravel; the broken curbs were replaced, and the access stairs to squares 7 and 9 were removed (Fig. 3c,d).

7.- The irrigation system was repaired by the replacement of damaged emitter rods with new plastic rods, the placement of new nozzle holders and new filters in the emitters, the replacement of all the nozzles and the unification of the whole system; as well as adjustment of the opening and reach of the nozzles of the diffusers. The location of the diffusers outside the figures and between the boxwood hedge was also changed to increase the efficiency (Fig. 3e,f).

Educational and Outreach, and Communication and Science Dissemination Units

Once the rose bushes were planted in the appropriate squares, information panels were designed. A digital interactive map with a QR was also added to the CHANEL visitors' guide, in order to show the specific location and a short description of each rose variety.

The communication plan was carried out in four phases to attract the attention of different sectors of the public and motivate them to visit the Rose Garden. First, after the signing of a collaboration agreement between RJB-CSIC and CHANEL Spain, a first press release was launched, informing about the sponsorship of the restoration activities by this well-known company, on the occasion of the 100th anniversary celebration of its rose-scented perfume Nº5. The next phase focused on the inauguration, with a press call a week ahead, to report the ceremony's date, time, place, and the authorities who would attend. The third phase was the inauguration day, when a press dossier was provided to the media, consisting of the press release, photographs of the event, and the interactive map. Finally, the last phase focused on two aspects: a) individual reports by the Madrid media with interviews of RJB and CHANEL staff; and b) the organization of guided tours for communication media directors and social media influencers.

Figure 2: Different actions undertaken in the Rose Garden ("La Rosaleda"). a,b: Renovation of the substrate; c: Relocation of some specimens; d: Placement of the mesh; e: Mulching. Photos: Beatriz Perlines.

Figure 3: Other activities carried out in the Rose Garden ("La Rosaleda"). a,b: Planting of new species; c,d: Restoration of the walking trails; e,f: Restoration of the irrigation system. Photos: Beatriz Perlines.

RESULTS AND DISCUSSION

Eighteen students and three teachers of the Gardening School were working in the Rose Garden (3.5 h/day/person), under the supervision of two technical staff of the Gardening and Arboriculture Unit. The pruning of the rose bushes was done in eight days, starting on February 17th (Total hours: 504). The restoration started on March 8th, and was carried out in 40 working days (Total hours: 2,520).

The composition of each of the four squares has a distinct theme. In square C7, wild species of the Iberian Peninsula from Sec. *Caninae* are grown: *Rosa agrestis* Savi*, R. caesia* Sm., *R. dumalis* Bechst., *R. glauca* Pourr., *R. penduliana* L., *R. pouzinii* Tratt., *R. rubiginosa* L., *R. stylosa* Desv. and *R. villosa* L.; as well as their varieties and hybrids. Also, modern roses from different groups of Sec. *Cassiorhodon* were planted at this square, such as *Rosa rugosa* Thund and a number of rose bushes derived from it (group Rugosa), among them 'Hansa', 'Fimbriata' or 'Thérèse Bugnet'; as well as those from group Kodersii (e.g. 'Dormunt'), and group Boursault (e.g. 'Blush Boursault'). Although the majority of the rose bushes in this square come from Europe, *Rosa virginiana* Mill. and *R. carolina L*., from Sec. *Carolinae* (North American species) were also planted in this square. In addition, square C7 also includes old rose bushes from Sec. Rosa, groups Centifolia ('Fantin Latour'), mainly in the central figures, and Gallica (*R. gallica* var. *officinalis*, known as the 'Tudor rose').

In square C8, there are planted specimens from the *Rosa* section, including bushes from the rose groups Alba (e.g. 'Königin von Dänemark', usually having more than 100 petals), Centifolia, Gallica*,* Muscosa and Portland, as well as their most primitive reflowering hybrids. Also growing in this square are the historical roses whose origin can be traced back to the 16th and 17th centuries, such as 'Quatre Saisons', 'Summer Damask', or the 'York and Lancaster' all from the Dasmask group. The modern rose 'Scharlachglut' from the Gallica group is cultivated in this square, as well.

Square C9 is dedicated to the *Chinensis* and *Synstylae* sections, together with some other groups within the *Rose* section. There are rose bushes from the well-known groups such as Tea Roses and their hybrids. One example of the most emblematic rose bushes that the visitor can find here is 'La France', the first Tea Hybrid obtained in 1867 by J.B. Guillot from Lyon (Coggiatti 1986), from *Rosa gallica* L., which marks the transition between ancient and modern roses (Joyaux & Lévêque 1998, p. 265). Also, Bourbon (e.g. 'Louise Odier', 'Vivid', 'Bourdon Queen'), Noisette (e.g. 'Crépuscule', 'Rêve d'Or'), Floribunda (e.g. 'White Pet', 'Nathalie Nypels'), Polyantha (e.g. 'Cécile Brunner', 'Paquerette'), Modern (e.g. 'Sparrieshoop') are cultivated. Also the 'Park's Yellow', a Chinese rose that brought the color yellow to Tea and Noisette roses.

Finally, square C10 is mostly dedicated to the cultivation of roses from the *Pimpinellifoliae, Laevigatae*, *Bracteata* and *Banksinae* sections. This square also includes specimens from the subgenus *Platyrhodon* with *Rosa roxburghii* Tratt. from China. *Rosa banksiae* W.T. Aiton, with an intricate morphology, and its tiny and abundant double flowers that are grouped in bouquets. The double white form of this species was introduced into Europe from China in 1807 by William Kerr (Graham Stuart 1994).

The interactive map is accessible through a QR code in the panel (Fig. 4a), and it is also available from the RJB-CSIC website (RJB 2021a). The navigation guide is shown in Fig. 4b. The user can click on one of the garden squares to see the position of each rose bush within that square (Fig. 4c). Also, it can select the name of the species, variety or

cultivar that appears on the label in the garden itself to obtain information on them (Fig. 4d). Examples of these factsheets, and the type of information provided, are shown in Figs. 4e-f: on a wild rose species from the Iberian Peninsula, *Rosa agrestis* Savi (Sec. *Caninae*, Fig. 4e); and an ancient rose variety, "Centifolia Muscosa" (Fig. 4f).

Figure 4: Information panel about the new Rose Garden ("La Rosaleda") (a) and the navigation guide of the interactive map (b-f). b: Selection of one square by clicking on it; c: Selection of a rose bush by clicking on the number; d: Selection of a rose bush by clicking on its name; e-f: digital factsheet on (e): a wild rose species from the Iberian Peninsula, *Rosa agrestis* Savi (Sec. *Caninae*); and (f): an ancient rose variety, 'Centifolia Muscosa'. Photos: Nacho Urbon (a).

Regarding the communication plan, the first press release was launched on March 25th (RJB 2021b). Instead of a photographic image of the in-construction Rose Garden, the information was accompanied by an illustration by designer and illustrator Jacobo Pérez Enciso (Fig. 5a). This first

news was picked up by more than 20 media organizations, mainly from the fashion sector, and by EFE, the main news agency in Spain and ranked as the fourth news agency in the world. This information was also disseminated on RJB three main social networks: Facebok, Twitter and Instagram.

On May 18th, the Rose Garden was opened to the public. Attending the opening ceremony were CSIC President, Rosa Menéndez, CHANEL-Iberia CEO, Olivier Lechère, RJB director, Esteban Manrique (Fig. 5b,c), and members of the Garden and general public (Fig. 5d). The event was attended by 12 media outlets (Fig. 5c), including two of the main television networks in the country, "TVE" and "Antena 3", which carried out reports on two of their programs. A press release was launched on this event (RJB 2021b). Around 30 media outlets reported on the inauguration: national newspapers "El Mundo" and "La Razón", the digital media "diario.es" and "Ok.diario", various radio stations ("Cadena COPE", "Libertad Digital", "Onda Madrid"), and different websites linked to the fashion and landscaping industry.

Four daily guided tours for media directors and social influencers were offered during the week days between May 19 and 26 (Fig. 5e). Around 200 people took part on these guided tours, with an average of 10 people per pass.

Figure 5: Illustrative drawing by artist Jacobo Pérez Enciso, which was included in the March 25th press release: (a); photographs of the inauguration on May 18th (b-d); a guided tour for the public (e). Photos: Nacho Urbon (b-e).

CONCLUSION

The restoration of the Rose Garden at Real Jardín Botánico-CSIC represents an example of partnership between the private sector and a public scientific institution. It showcases the value of cooperation among different staff units, involving gardening activities, training and formation, and education and communication in science, for the benefit of society at large. Finally, It represents an example of recuperation of an impoverished, depleted soil in a 18th-century historical botanical garden.

AKNOWLEDGMENTS

We thank CHANEL, the French fashion house, for funding the restoration of "La Rosaleda". We also thank all students at the Gardening School 2020-2021 of RJB-CSIC involved in the restoration; and the SEPE (Servicio Público de Empleo Estatal of Ministerio de Trabajo y Economía Social) for financing the Gardening School. Thanks to Esther García, head of RJB Archive, for help in locating information about "La Rosaleda". Thanks to Marian Glenn (Seton Hall University) for English revision.

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THE REAL JARDÍN BOTÁNICO (RJB) OF MADRID, 265 YEARS AT THE EDGE OF THE BOTANICAL RESEARCH IN SPAIN: NEW CHALLENGES AND CONSERVATION APPROACH.

ESTEBAN MANRIQUE

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ABSTRACT

Since its creation in 1755 by the King Ferdinand VI and his transfer to its current location on the Paseo del Prado in Madrid in 1781 by King Carlos III, the RJB has gone through by periods and vicissitudes of a very variable nature. But, nevertheless the RJB has managed to get out forward until today. Therefore, 265 years have shaped a Garden that then and now shines for its scientific quality, its botanical collections, and its activity in environmental awareness in the center of the city of Madrid (Spain). From 1940 onwards, the RJB belongs to the National Scientific Research Council of Spain (CSIC) as a research institute in botany and fungi.

It is precisely that age what now makes the RJB more vulnerable to new environmental factors arising from human activities and the passage of time. On the one hand, the age of its living collections, especially the old trees, makes its conservation a difficult task in a polluted and hostile environment as it is the city of Madrid. Besides, the soil compaction after the passing years hinders the percolation of rainwater or irrigation. Moreover, air pollution, new pests and diseases and climate change are the new problems that the botanical gardens currently face. To face these factors, we will need to joint efforts to develop new strategies and tools. Along this presentation we will analyze each of these factors for which the RJB has to find adaptation or mitigation solutions.

Key words: Real Jardín Botánico, botanic gardens conservation, climate change, atmospheric pollution, soil compaction, pests and diseases.

CONSERVATION AND RENOVATION OF THE HISTORIC GLASSHOUSE OF THE BOTANICAL GARDEN GRAZ 1888–2021

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ABSTRACT:

The Graz Botanical Garden was founded in 1811 by Archduke John of Austria, in what is now the center of Graz. However, already by the middle of the 19th century, the garden stood in the way of urban development and the search for a new location was underway. The plan was realized in 1888, when a new site was found on the outskirts of the city. The first building to be erected on the new site was a glasshouse consisting of five parts, constructed by the k. k. *Eisenkonstruktionswerkstätte Ignaz Gridl* metalworking company in Vienna, which had built the famous Palm House at Schönbrunn in Vienna six years earlier. Structurally, however, the installation in Graz was a much more modern, and more strictly functional, building. The house was in operation for over 100 years, but by the turn of the century the structure began to show its age. In 1995, the botanical collections were moved to the newly built glasshouse on the other side of the garden, and the historic glasshouse fell into disrepair. In 2008, the glasshouse was listed as a historic monument, though it was not until 2019 that funds were found to renovate it. During the renovation, the foundation was renewed, the steel structure was partially rebuilt and adapted to modern building codes, and the facade was newly glazed. On September 22, 2021, the building was opened and entrusted to the Botanical Garden by the University and the City of Graz, to once again fulfill its intended purposes of education, community outreach, and recreation.

Keywords: Historical monument, Refurbishment, steel construction

THE FOUNDING HISTORY UNTIL 1889

The history of the Botanical Garden in Graz begins in 1811 with the establishment of the first Botanical Garden at the Joanneum in the old city center by Archduke John (Teppner 1997, Fig. 1). Along the *Neutorgasse* in Graz, this garden was intended to serve the "teaching of botany", the "art of plant cultivation" and the "dissemination of useful plants". Visitors were shown the practical side of the plant kingdom, grafted fruit was grown, and cuttings were passed on to the populace. The site also came to be treasured as a public park (Ster et al. 2011).

After more than 60 flourishing years, and despite fierce protests by the people of Graz, the garden was gradually pushed out in the course of the city expansion. The university showed interest in taking over the site, and Hubert Leitgeb (1835-1888), the first full professor of botany at the University of Graz, was commissioned to plan a new botanical garden and a separate institute building on a site east of the city. In 1874, a plot of land belonging to the Reininghaus family in the Schubertstraße was purchased for this purpose, but it was only about half the size of the old botanical garden (approx. 2 ha). Although several

attempts were made to expand the grounds in the following years, these were ultimately unsuccessful to be treasured as a public park (Ster et al. 2011).

Fig. 1: Botanical garden at the Joanneum in Graz, watercolor by Johann Nepomuk Passini, 1865. Joanneum Graz, Neue Galerie.

After more than 60 flourishing years, and despite fierce protests by the people of Graz, the garden was gradually pushed out in the course of the city expansion. The university showed interest in taking over the site, and Hubert Leitgeb (1835-1888), the first full professor of botany at the University of Graz, was commissioned to plan a new botanical garden and a separate institute building on a site east of the city. In 1874, a plot of land belonging to the Reininghaus family in the Schubertstraße was purchased for this purpose, but it was only about half the size of the old botanical garden (approx. 2 ha). Although several attempts were made to expand the grounds in the following years, these were ultimately unsuccessful (Ster et al. 2011).

Leitgeb pursued his task with great enthusiasm, and in the course of his work he turned down professorships at renowned universities such as Tübingen, Jena and Vienna, as he was considered one of the most renowned bryologists of his time. He visited botanical gardens across Europe to learn about the design of gardens and the construction of glasshouses. Large, imposing glasshouse buildings were "in vogue" throughout Europe at that time, and this ideal strongly shaped Leitgeb's plans. In particular, he advocated for a building with a 12 m high central section to be used as a palm house (Fig. 2). In his 1882 program proposals, he also strongly advocated for a “Victoria House” for the culture of tropical aquatic plants with a sunken, heated water

basin six meters in diameter and one meter deep. His plans also called for double glazing for all parts of the house – a major expense that is lacking even in many of today's glasshouses.

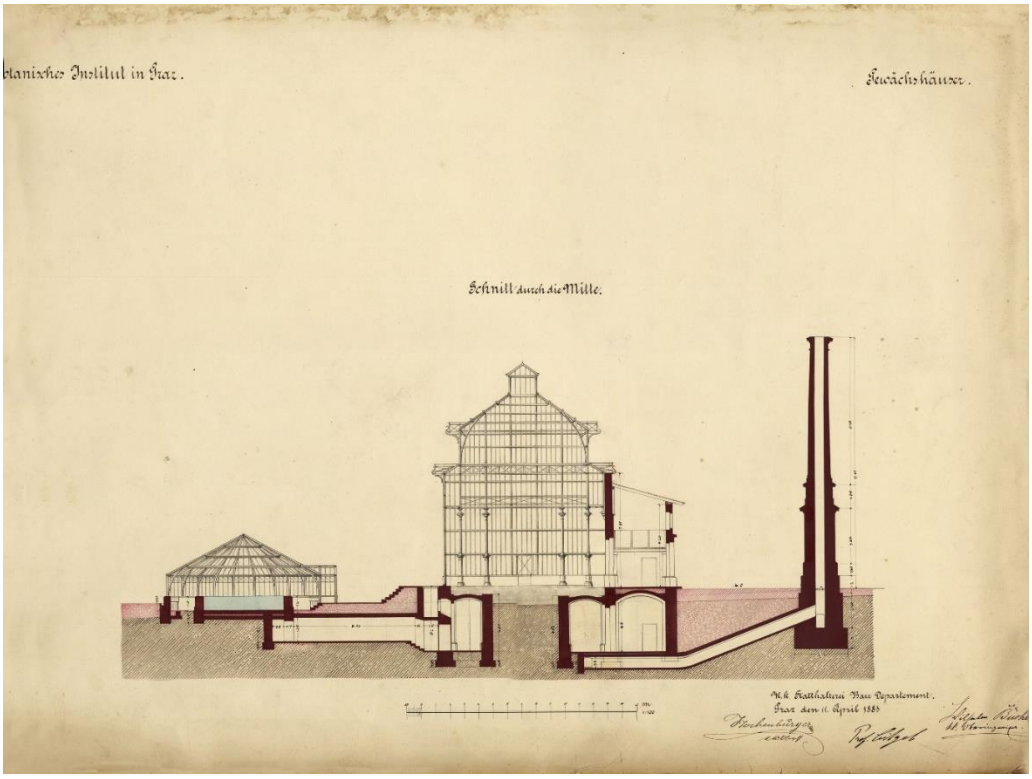

Fig. 2: Unfinished plan of the glass house by Hochenburger, 1883. Universitätsarchiv Graz.

Leitgeb waged a hard-fought campaign with the University of Graz and the Imperial Ministry of Culture and Education to obtain funding for the glasshouse and institute building. However, the imperial decision that fell on July 14, 1887 only approved a greatly reduced form of the glasshouse with a smaller heating system, and without the Victoria House. A tiny gardener's house was approved, but the commitment for a new institute building would not be realized until many years later. Pained and resigned over the failure of negotiations with the ministry, and following several other setbacks in his private life, left Leitgeb a broken man, and in 1888, he ultimately committed suicide (Ster et al. 2011).

One of the first tasks for Leitgeb's successor Gottlieb Haberlandt (1854–1945) was to move the plants from the old Botanical Garden at the Joanneum to the University Garden. The garden planning that took place under Haberlandt is still recognizable today in the site's basic form and features. Among the few plants that have been documented from the former Joanneum Garden are specimens of *Ceratozamia mexicana*, which are thus among the oldest plants in the present botanical garden.

The order for the glasshouse building was awarded to the k. k. Eisenkonstruktions-werkstätte Ignaz Gridl from Vienna and was executed according to the plans of the *Oberbaurat* Franz Ritter von Hochenburger and the engineer Johann Beyer in 1888–

1889 (incidentally, the same year of construction as the Eiffel Tower in Paris). It is thus one of the oldest architectural structures on the Graz University campus (Figs. 3 and 4). The Gridl company was a European leader in glasshouse construction at the time. In 1882, it built the famous Palm House at Schönbrunn Palace in Vienna, as well as glasshouses for the high nobility, the wealthy bourgeoisie and for horticultural businesses Schoeller & Fogarassy 2011

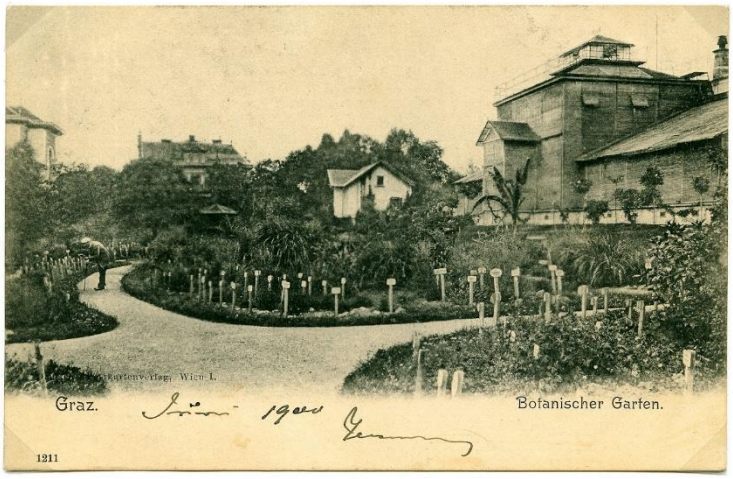

Fig. 3: Picture postcard from around 1900. In the foreground the Systematic Department, behind it the glasshouse and to the left the Gardener's House. Archive Botanical Garden, Graz.

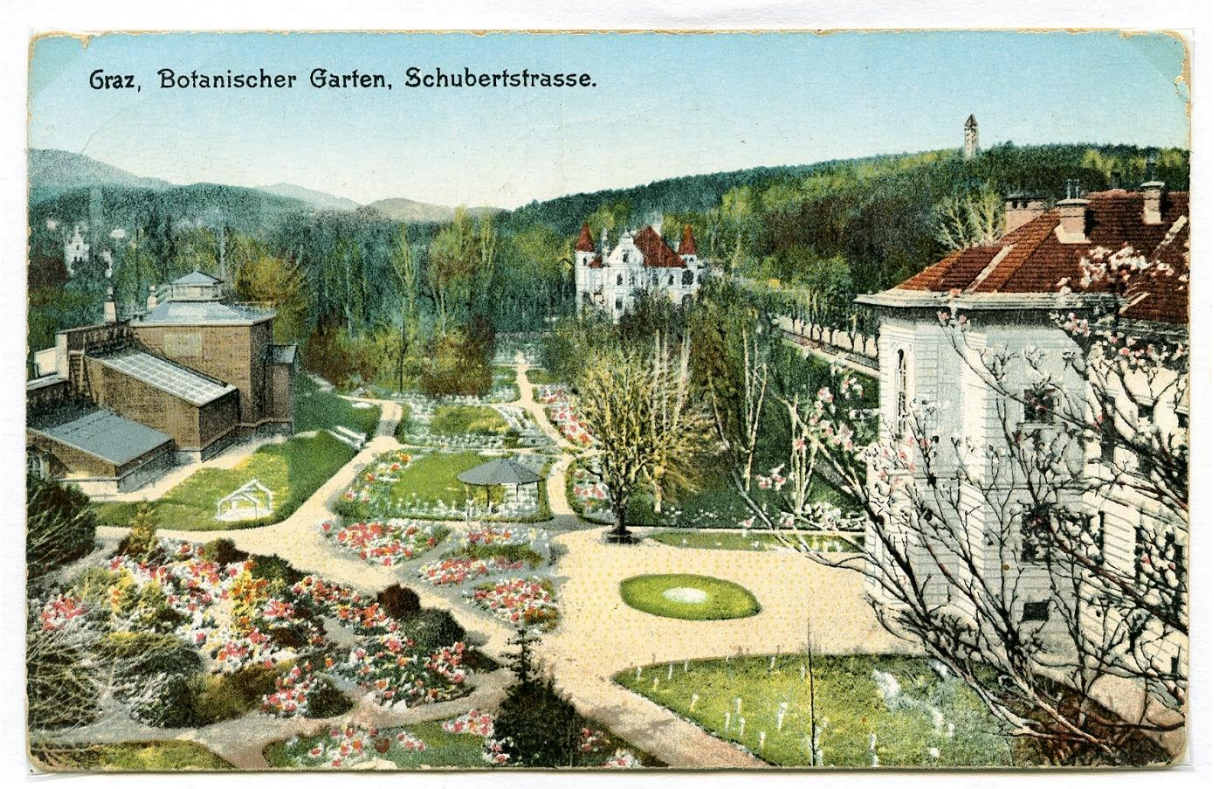

Fig. 4: Picture postcard around 1908. In the foreground the alpine plant complex, on the right the new Botanical Institute (built in 1906), on the left the glasshouse. Archive Botanical Garden, Graz.

Although the Graz glasshouse is built in the tradition of the magnificent glass palaces from the mid-19th century, it already represents its own type of building with strict, rectilinear forms. The central cube dominates with its pyramidal roof, tower spire, and outer walkway with iron railings

and scroll-shaped decorative elements. Symmetrically attached on both sides are two saddle houses. The whole complex is attached to a brick rear building.
The glasshouse was one of the first to be offered as a “series product”. Due to its iron (steel)-glass construction and its strict functionality, it is a precursor of modern building designs, but also the last representative of its kind in Austria today.

All contemporaneous glasshouse buildings in Austria, e.g. the original Palm House of the Botanical Garden in Innsbruck, are no longer standing. Together with the “Iron House”, which is integrated into the Graz *Kunsthaus*, the historic glasshouse of the botanical garden is therefore one of the only surviving witnesses to the iron (steel) architecture of the 19th century in Gra

ONGOING OPERATION FROM 1889 TO 2020

The opening of the Botanical Garden Graz at a new location in Schubertstraße in 1889 marked the beginning of more than 100 years of use of the historic glasshouse in Graz as a plant cultivation site for research and teaching. The plants were mainly potted, with only a few open planting areas available for cultivating larger individuals. The two saddle houses to the southwest were designed as warm houses, while the large central cube and the two saddle houses adjoining to the northeast were designed as cold houses. The absence of the Victoria House, which had been cancelled during the construction phase due to lack of funds, was painfully noticeable during operation, and as early as 1925, the Ordinary Karl Fritsch (1864-1934) advocated an extension of the house. The addition could only be realized under the Ordinary Felix Widder (1892-1974) in 1950, resulting in a simple, rectangular Victoria House with two side wings in front of the glasshouse, where the bromeliad, orchid, and succulent collections finally found sufficient space (Fig. 5).

The masonry rear section of the glasshouse housed the operation and social rooms for the gardeners, as well as the coal-fired heating system. Since reductions were made to the heating system in 1888/89, the solid fuel heating system was problematic from the start. Plans were made to renew the heating system several times, but these always failed due to lack of funds. It was not until 1971, shortly before the oil price crisis of 1973, that the heating system was converted to oil. However, this brought little improvement to the situation, as the outdated heating system essentially remained in place, even when the glasshouse was connected to the district heating network of the city of Graz in 1983.

The building was generally not open to the public, except for individual "open days", when people outside of the institute or garden were also allowed access.

Apart from the heating system, the glasshouse was extremely functional. However, an ongoing lack of space, and problems with the general state of the

building, led to debates about additions and renovations from Fritsch's time onwards. The university largely left the garden alone, with only most necessary repair work being conducted. The glasshouse survived the bombings of World War II, but concerns about the state of the building remained. In the 1980s, the condition of the house had deteriorated so much that it was no longer usable. In 1982, architect Volker Giencke was commissioned to plan a new glasshouse complex suitable for public use, which was begun in 1989 and was to take 6 years to complete.

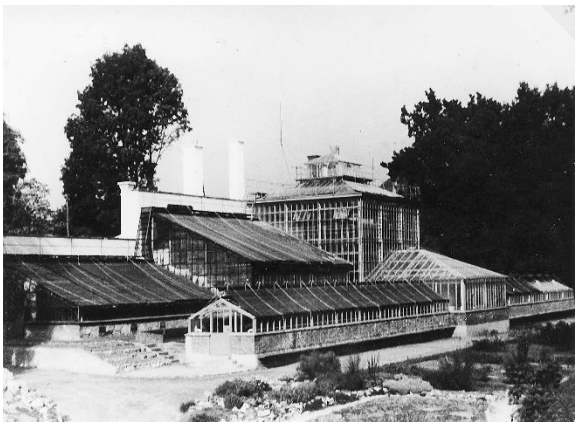

Fig. 5: The addition built in 1950 in front of the historic Glass House with the first *Victoria* House in Austria. Archive Botanical Garden, Graz.

With the relocation of all plants to the new glasshouses in 1995, the historic glasshouse was largely abandoned (Fig. 6). Initially, it was to be demolished, but at an early stage more and more voices were raised to preserve the old glasshouse for cultural and historical reasons (Stadlober & Wentner 2010). Although a new renovation and utilization concept was agreed upon, the funding from the city, the state and the federal government ultimately fell through.

Thus, the historic glasshouse, unused and in the meantime condemned by the building authorities, sank into a long Sleeping Beauty slumber. In 2007, the forces for the preservation of the historic glasshouse regrouped and obtained its protection by the Federal Office for the Protection of Monuments on June 12, 2008.

It was to take another 10 years before the *Bundesimmobiliengesellschaft* (the ownerof the glasshouse), the university, the botanical garden, and the preservation authorities joined forces to tackle the restoration of the glasshouse. Many feasibility studies, static calculations, material tests, financing plans and, last but not least, utilization concepts had to be worked out before things really got underway in May 2020.

Fig. 6: The historic glass house – ruin and monument. Elisabeth Brenner 2008.

RENOVATION AND FUTURE USE

Preparations for the renovation work on the historic glasshouse began in April 2020, following the demolition of the front buildings from 1950 that were not part of the monument in 2019. The brick building at the rear and the flower beds behind the house were also demolished, and the construction site cleared and prepared. From May 11, 2020, the construction work started first with the removal of the old glass, and then with the underpinning of the entire glass house in order to demolish the old foundation and the retaining walls – a masterpiece of construction engineering (Fig. 7)!

Fig. 7: The steel structure is jacked up. Christian Berg 22.06.2020

After the concrete foundation and base had been rebuilt, the still "free-floating" glasshouse was enclosed for sandblasting work (Fig. 8). Each part of the building was sandblasted separately and then reconnected to the new foundation. In the process, the protected steel structure was largely preserved, while the connection between the steel and the foundation had to be completely rebuilt. In Fig. 9, one can see the attachment of the new steel (bottom) to the 19th century steel (top). In order to meet the requirements of modern building codes, the structure was reinforced with additional carrier elements.

Fig. 8: Enclosure of the building to protect against emissions. Christian Berg 15.09.2020.

Fig. 9: Detail of the steel structure, above the historical steel, below the renewed steel Christian Berg 29.09.2020.

This was done in coordination with the preservation authorities in such an inconspicuous way that it is hardly noticeable to the untrained eye (Figs. 10 and 11). The overall impression of the building has not suffered any change as a result.

Subsequently, a new layer of green paint, matching the original as closely as possible, was applied in coordination with the Federal Office for the Protection of Monuments.

Fig. 10: Detail of the steel structure with screwed-in reinforcing element Christian Berg 29.09.2020

Despite efforts to preserve the original floor structure, the decking had to be removed and the floor excavated in all of the houses. Although parts of the paths were damaged by the demolition work, the dense stand of *Ailanthus altissima* growing in the middle of the greenhouse was one of many reasons for why the floor had to be rebuilt (Fig. 12).

Fig. 11: Detail of the steel structure with bolted-in reinforcing elements Christian Berg 26.09.2020.

The renovation of the rear part of the building also took place in the summer of 2020. In the process, the roof truss and the tin roof were restored to match their original states as well.

After the painting work was completed, the glazing of the houses began at the end of September 2020. All roof surfaces were fitted with laminated safety glass and all vertical surfaces with single-pane safety glass. By the end of December 2020, most of the glazing work had been completed. The remaining surfaces were provisionally sealed to enable heating operation in winter.

Fig. 12: *Ailanthus altissima* had conquered the glasshouse. Elisabeth Brenner 2008.

In January 2021, construction work began on the outdoor facilities around the historic glass house. Behind the glass houses, a service yard with a flying roof was created. At the forecourt, the preliminary work for the flower beds, stairs, ramp and the entrance was carried out. Then in the spring of 2021, the glazing was completed, and the shading installed. In March 2021, the glass house received a vestibule in the entrance area, as a modern solution with an automatic door (Fig. 13). The intention here was to set a modern counterpoint to the historical building.

Fig. 13: The modern entrance area. Christian Berg 29.09.2020.

In May 2021, all installation work, ground construction, painting and locksmith work was completed. The rising temperatures now enabled work to be carried out on the renovation of the district heating system for all the buildings on the garden site, as a result of which the garden's path system was also renewed using *HanseGrand* water-bound building material. Connection to the district heating system, as well as to the public water network, took place in the summer of 2021, and the planting of the outdoor areas was completed by late summer. The building was ceremoniously handed over to the public on September 22, 2021. (Fig. 14)

The future use of the "new" historic glasshouse varies for the five individual sections. The smaller, outer wings will serve as nursery houses for the Botanical Garden. The southern of the two larger wing houses will function as a research greenhouse for the department of plant physiology, and for growing plants for teaching. The northern large wing house is the new educational home of the "outdoor laboratory," which has worked for many years to teach botanical knowledge to people of all ages. This finally opens the possibility to offer practical work and workshops in a "botanical atmosphere" independent of the weather.

Fig. 14: On the day of the opening. Christian Berg 22.09.2021.

The highlight for the public will undoubtedly be the "Plantarium", as we have christened the central cube. This will be a freely accessible space during the opening hours of the Botanical Garden, where exhibitions and university events can take place.

The renovation of the historic glasshouse was a major step towards preserving a glasshouse tradition in Graz that is over 100 years old.

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THE WISE TREES PROJECT - AN INITIATIVE FOR PROMOTING HISTORIC BOTANIC GARDENS OF THE CARPATHIAN BASIN IN WISE MANAGEMENT AND FAMILIARIZATION OF HISTORIC TREES

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ABSTRACT:
Hungarian Association of Arboreta and Botanic Gardens developed a project with the mission to give long life, spotlight and reputation to historic trees living in botanic and/or historic gardens and to support gardens, especially botanic gardens and arboreta in the Carpathian Basin, the historical territory of the former Hungarian Kingdom in accomplishing this mission. WISE TREES initiative of HAABG provides complex means for complex needs of Hungarian botanic gardens and arboreta, as well as historic gardens, but with a special focus, which is historic trees. The planned activities of the project take into account that garden maintainers of the region have to manage these valuable trees in poor monetary and human conditions and without adequate legislations for how to treat historic trees as part of the natural and national heritage.

With the support of the Slovakian-Hungarian Interreg Program of the European Union, HAABG in partnership with the Slovak National Trust could start the Wise TREES project in 2021 and lay the grounds of a long-term strategy.
The innovative mindset of the project focuses on and involves all stakeholders in finding complex solutions. An important feature of our approach is interdisciplinarity which we realize in practice involving several experts with different knowledge, such as botanists, dendrologists, historians, arborists or tourism and communication experts.

KEYWORDS:
veteran trees, historic value, arboriculture, interdisciplinary, Carpathian Basin

INTRODUCTION

Trees, especially old, giant trees are of constantly growing public interest by many reasons. Even more scientific findings prove that trees are guardians of the Earth's future climate livable for humans with all their positive impacts on the environment. Veteran trees are guardians of the past and history at the same time, they are part of our national and of the world heritage. They are evidences of extreme adaptability and giving life space to a diverse community of living organisms. With all these features historic trees astonish, affect and teach people. Thinking over this complexity, we found WISE as the most adequate attribute to historic/veteran trees in our initiative.

Wise trees are key values and key attractions of historical botanic gardens expected to be retained, on the other hand special maintenance needs of these trees face garden managers several hard problems to solve and requires serious resources.

WISE TREES project offers complex solutions taking into consideration limited capacities of gardens in Carpathian Basin and involving different resources. Our focus on historic trees as ambassadors of gardens is an innovative approach in garden tourism as well.

MATERIALS AND METHODS

Why did we put historic trees in focus? HAABG was established as an umbrella organization in 1992 with its mission of representing the interest of its members in order to revive living plant collections and historic gardens in Hungary and to promote professional co-operation among them. The 21-century changes are constantly bringing new expectations and beside the representation role, HAABG should act more and more also as service-provider for its member gardens. But what is the level of HAABG in finding solutions for even more complex needs of its 50 members gardens? We were analyzing all circumstances similar to SWOT and we found that although our weakness is our limited capacity especially in terms of staff and money but we have a very significant wide knowledge and long-term experience, additionally a broad national and international network, so we have been able to apply for funds. As we do not have the potential to offer solutions for all needs of gardens, we decided to find one special focus which has a strong botanical importance and high public interest in the same time. The

market research showed a real growing interest in trees especially in trees of community or of historic importance. As one example, just look at the international movement of The European Tree of the Year, where a huge Hungarian Judas tree (*Cercis siliquastrum)* won the contest in 2019 with 45.132 votes. Besides we found several other evidences and data which proved the growing public interest in unique veteran trees.

Maintaining big old trees is a real challenge to botanic gardens even if maintainers are aware of the importance of this task. Arborist expert checking and handling of such a huge and important tree requires a special attention and professional knowledge but first of all a dendrophile approach where the aesthetic value and extending the life of the tree is as important as the security of visitors. HAABG has this knowledge, too.

This issue has an additional value that beside its member gardens, HAABG can involve historic gardens as well, which did not have a specific association in Hungary that time, meanwhile there are numerous valuable specimens in those gardens which may be in the interest of botanic gardens.

The Wise Trees initiative plans for long time and this ambitious plan needs constant public and professional attention in order to be capable to involve different supports. This pressure can be interpreted as an opportunity to link science and profession with people.

The Wise Trees pilot project

That point fortune favored us. In 2019 The Slovakian-Hungarian Crossborder Cooperation Program announced a last call, to which Priority 4.1. – Improving the level of cross border inter-institutional cooperation and broadening cross border cooperation between citizens – our Wise Trees initiative could be fixed.

Slovakian National Trust / Národný Trust n.o. has been collecting, monitoring and developing historical gardens of Slovakia for some years. On the website www.nasprak.sk 48 historical gardens are presented. They experienced the same situation and needs in Slovakia so we started our cooperation and obtained support for our project. With this financial support we can create the basics for the program even if we have to count with many compromises, such as e.g. a strong territorial restriction as we can involve only gardens of the Slovakian-Hungarian border region and we have to work with a limited staff. On the other hand, with these small scale project we can pilot our concept.

Taking all findings and circumstances into consideration the direct objective of the project is to develop a package of new cross-border services for the maintainers of botanic and/or historic gardens of the SK-HU border region in treatment, interpretation and promotion of their tree heritage.

The WISE TREES project has strong environmental and at the same time heritage protection aspect, as it focuses on more than 100-year-old veteran trees with historic and social value living in protected sites.

In the frame of the project we plan to

- compile an inventory of wise trees and their home gardens from dendrological, historical and tourism services aspects,
- give practical knowledge and complex approach to garden managers in the form of a modular veteran tree management training
- support tree survey of 80 trees and arborist handling of 10-20 trees
- develop online and on the spot public services to encourage people, especially

families to visit botanic and historic gardens, and let them experience the exciting history and ecological importance of trees and gardens from different aspects with innovative methods (like interpretive storytelling, Tree feast festival)
- develop the Wise Trees website which is a richly illustrated database of historic trees and gardens with advanced searching possibilities and also a garden trip planner for people.

With these activities we want to reach a high visibility and publicity and a broad cooperation network of different stakeholders for sustainability. After this EU funded project WISE TREES initiative has to be ready to generate different public and private funding actions.
We started to work in January 2021. After 6 months we could build up the biggest cooperation network in the history of HAABG, which proves the need for Wise Trees project.
The two most important national heritage management organizations, the National Heritage Protection and Development Non-profit Ltd. and the Institute of Hungarian National Heritage proposed trees and provided data. We cooperate with diverse garden maintainers, such as municipalities; educational- social and health care institutions; forestry companies and heritage management foundations. Beside Hungarian Ramblers' Association is also our strategic partner. This diversity of cooperating partners is the biggest challenge of the project.
Beside professionals we aim to involve and sensitize public. We want to encourage people of all ages to get known and respect these unique creatures and to support those activities needed for their health care and protection.

Basic criteria of selecting partner gardens:
- Established and built out as a garden. Botanic Gardens, arboreta and historic gardens are in focus but public parks can be involved if the original garden structure and representative species still can be experienced
- Open for the public (at least occasionally)
- At least one 100-year-old tree lives in the garden

Aspects of tree selection (in this pilot phase):
- the age of the tree is at least 100 years
- list of trees become rich in species
- list of trees involves endemic and exotic species as well
- cooperate different type of garden maintainers (public & private), diverse partnership
- to show well known and famous gardens and hidden treasures as well
- balanced geographical distribution

Different methods of data collection have been used. We contacted all experts who was searching, researching and registering historic trees or historic gardens into a database, some of them are public, others were results of still not published researches prepared by university students and young researchers.
We collected actual information directly from garden maintainers with a questionnaire and the Expert Committee of Wise Trees project also suggested tree specimens and gardens worth to check and involve. Historic garden specialist, dendrologist, plant health specialist, tourism expert and internal professional leaders have cooperated in the interdisciplinary Expert Committee to

propose methods and contents to the database, evaluate and validate data and make different selections of trees and gardens for the planed actions (arborist checking, arborist handling, promotion on the website or only being part of the database) according to different aspects.

A gardener staff member was responsible for gathering all possible data, prepare a basic database of all gathered more ten thousand records and organizes the database into a long list for the Expert Committee and for the IT team preparing the Wise Trees website. We use Ms Excell software and a cloud storage for the documentation behind the database, but this is one point, where we realized after the evaluation of this workphase that these tool and methods are not flexible enough for our multiple tasks, searching and filtering such a diverse database for so many different purposes. Every expert needed data in different structures according to its own professional aim and reorganization of the excell charts needed unbelievably much extra time.

As HAABGs aim is to expand the Wise Trees initiative for the whole Carpathian Basin, we have to develop further our database method.

Figure 1: Target map of Wise Trees project, generated by the Hungarian Association of Arboreta and Botanic Gardens in partnership with National Trust of Slovakia

RESULTS

The project is at the beginning phase. In the database we already collected more than 200 trees from 42 botanic and historic gardens of 7 northern counties of Hungary and of Budapest. National Trust of Slovakia collected already appr. 80 trees in 48 gardens from 5 counties of Slovakia.

We present here a selection of some Hungarian Wise Trees from the database which represent a typical or on the contrary a special feature or aspect and thus shows the specialties of the Hungarian historic and botanic garden field. These aspects were also considered in planning of searching aspects of the public online database and garden trip planner of which development has just started.

Some uniqe example of selected wise trees and gardens

Platanus orientalis in Kende-Kölcsey castle park

Situation: Cégénydányád, North-East Hungary.

Age: 180-150 years

Hight: 31 m

Perimeter of the trunk (at 1 m hight): 494 cm

Maintainer: Hortobágy National Park

Unique value from the project's perspectives: *Platanus orientalis* is a rarely planted species in Hungarian gardens. Such an old individual is especially valuable, as this species hardly tolerate winter frosts in the Carpathian Basin. In the castle the NP operates a visitor center. Nonetheless the park is not part of the guided tour, although there are several other unique and wonderful old trees in the garden. like other huge different species of *Platanus* individuals or a *Liriodendron tulipifera cv. Aureo-marginatum.*

We can say, that plane trees are most liked tree species in Hungary, that is why we suppose, that highest number of searches on the website according to species will be for plane trees and for oaks, that is why we involved one individual of these species from all regions.

(Figure 2.)

Figure 2. A 150-180 year old Platanus orientalis in Kölcsey-Kende castle garden, Cégénydányád Hungary

Ginkgo biloba in Füvészkert ELTE Botanic Garden

Situation: Budapest, Hungary

Age: appr. 200 years

Hight: 25,5 m

Perimeter of the trunk (at 1 m hight): 340 cm

Maintainer: Eötvös Lóránd University

Unique value from the project's perspectives:

This group of trees is the oldest and highest ginkgo in Hungary plus ginkgo is a famous and extremely interesting species in terms of non-formal education. Füvészkert is one of the most important and oldest

Hungarian botanical collections. It is barrier-free and easily accessible also with public transport so it is famous among families and old people as well. This tree and this garden meet most of botanical, historical and also touristic expectations, thus it can be one "flagship" of the project. (Figure 3.)

Figure 3.: 200 year-old Ginkgo bilobas in ELTE Füvészkert Botanic Garden, Budapest Hungary

Robinia pseudoacacia in the inner courtyard of the former Szapáry castle
Situation: Bábolna, North-West of Hungary
Age: 311 years
Hight: 17 m
Perimeter of the trunk (at 1 m hight): 650 cm
Maintainer: Bábolna National Stud Estate Ltd.
Unique value from the project's perspectives:
This is the oldest Hungarian tree in the Wise Trees database. According to the historic documents this tree was grown from seed and the oldest *Robinia pseudoacacia* in Central-Europe. It is a huge, amazing creature with rich (his)tory. It saw the most famous Hungarian race horses and studs trotting round the stud yard. Unfortunately, it is in a bad condition, so this tree will be one which will receive a serious arborist handling in the frame of the project.
(Figure 4.)

Figure 4.: 311 year-old Robinia pseudoacacia in the central courtyard of Szapáry castle, the center of Bábolna National Stud Estate, Hungary

Cedrus libani in Cziráky castle park
Situation: Dénesfa, North-West Hungary
Age: appr. 120 years
Hight: 26 m
Perimeter of the trunk (at 1 m hight): 333 cm
Maintainer: Lumnitzer Sándor Hospital – National Heritage Protection and Development Non-profit Ltd.
Unique value from the project's perspectives:
This historic garden is a very interesting forgotten garden, where many wonderful old wise trees live. The selection represents the trend of typical collections founded at

the turn of the 20th century in the western counties of Hungary with certain species and varieties of exotic evergreeens especially conifers. We plan a category in the searching possibility of the public database and trip-planer, which is "hidden treasures for adventure seekers". We would like to draw attention to those historic gardens, which are worth and should be treated according its high national and natural heritage value. Besides the life story of founders and owners of this castle and garden is so extreme and adventures, which is a great possibility for the interpretation by the newly developed audio guide app system and in 'history of the tree' section on the website.
(Figure 5.)

Figure 5.: A 120 year-old Cedrus libani in Sziráky castle park in Dénesfa, Hungary, waiting for cleaning and renovation of the protected historic garden, where it lives.

CONCLUSION

The Wise Trees initiative and the project generated such a high interest and cooperation which certifies its usefulness and need. After the first half year evaluation, we realized that thanks to this broad interest it is a bigger challenge, than HAABG planned, which is good from the perspective of sustainability but we have to mobilize all capacities of the Association and modify the method of realization of some outputs and planned results. The collection of involved historic trees and historic gardens show an invaluable tangible and intangible heritage of which management and promotion is a great responsibility. HAABG is an adequate entity in Hungary which has the professional and the networking potential for building and sustain a system for the protection and promotion of historic trees living in Hungarian historic and/or botanic gardens with the involvement of most possible stakeholders.

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RARE AND THREATENED PLANT SPECIES IN THE LIVING COLLECTIONS OF THE LISBON BOTANICAL GARDEN AND TROPICAL BOTANICAL GARDEN. PRESERVING THE PAST, THE PRESENT AND CONSERVING THE FUTURE

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The Lisbon Botanical Garden with an area of 5 ha is a scientific garden created in the mid-nineteenth century to complement modern teaching and botany research at the Polytechnic School. Here established between 1609 and 1759, however, it is only in 1873, through the initiative of the Count of Ficalho (1837-1903) and Andrade Corvo (1824-1890), teachers at the Polytechnic School, that the planting begins. The vast diversity of plants was first planted by the German Edmund Goeze (1838-1929) and the French Jules Daveau (1852-1929), Edmund Goeze, the first chief gardener, outlined the "Class" and Jules Daveau was in charge of the "Arboretum."

The Tropical Botanical Garden was created on January 25, 1906, by Royal Decree, situated, from 1914, in Belém (Lisbon) under the guidance of Henry Navel, French landscape gardener, occupying seven hectares near the river Tagus. It has been enriched with a remarkable diversity of native and important exotic plant species especially from tropical and subtropical regions. Was conceived as a Colonial Garden with a center of experimentation of cultures and as a space to accumulate knowledge regarding tropical agriculture and forestry.

Both gardens have numerous species with conservation interest. Plant diversity is currently being lost at an unprecedented rate, currently about a third of the world's

300,000–450,000 vascular plant species face extinction due to a variety of devastating anthropogenic activities, including destructive agricultural and forestry practices, establishment of pastures for farming, urbanization, land-use changes, exotic invasive species, climate change, pollution, systematic fires, illegal harvesting of seeds, wild juvenile, and adult plants etc. Due to the habitat threats, area of occupancy (AOO) and the extent of occurrence (EOO) are experiencing a continue declining for several taxa, and the plant populations is expected to continue declining into the future.

The living collections of the botanical gardens are also a potentially valuable source of material for reintroduction and restitution of vegetation and plant communities and there are already several examples of species considered to be extinct in the wild being reintroduced into their natural habitat thanks to botanical gardens specimens.

The National Museum of Natural History and Science of the University of Lisbon is responsible for the management of the two gardens, and both are national monument by the Ministry of Culture.

Key Words: Botanical garden, conservation, biodiversity, living collection, IUCN

THE HISTORY IN THE STONES OF THE BOTANICAL GARDEN OF THE UNIVERSITY OF COIMBRA

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ABSTRACT:
Two and a half centuries of history stand out from the living and built heritage to discover in the Botanical Garden of the University of Coimbra (JBUC). Founded by Marquis of Pombal in 1772, today it brings together a plethora of educational contents, transversal to many subjects.

With the purpose of multiplying this vast and differentiated knowledge, the training course "Conhecedor intérprete do Jardim Botânico da Universidade de Coimbra" is open to participants having higher education formation, on any disciplinary areas, encouraging the creation of new projects.

In the 2019/2020 edition of this Course, a new interpretative itinerary entitled "Historical visit through the JBUC's statues" is created through the statues and biographies of its Directors, architectural elements, and plants from the 4 corners of the world. Predicted to last 90 minutes, the trail is intended for all audiences, being

particularly aimed for students starting from the 6th school grade, with special interest to secondary education.

With an information leaflet, the itinerary starts in the east gate, continuing through the Júlio Henriques Terrace and tropical greenhouse, followed by Lake Luís Carriço and the Central Square, the oldest terrace in the Garden.

In five main moments, this visit crosses the history of the mentors and individuals, from different origins and backgrounds, who left their mark in the Garden: Domenico Vandelli, Dalla Bella, Manuel Galinha, Félix de Avelar Brotero, Soares dos Reis, Henrique do Couto d' Almeida, José do Canto, Pedro Pezerat, Edmund Goëze, Antonino Rodrigues Vidal, Júlio Henriques, Soares Barata Feyo, Luís Carriço, José Pereira dos Santos, Abílio Fernandes, Rosette Batarda, Cottinelli Telmo, Luís Cristino da Silva and José Mesquita.

Surrounded by beautiful specimens, it is unavoidable and enriching to present and describe the characteristics, properties and curiosities of some plants, alternating history with Botany. *Ginkgo biloba*, *Liriodendron tulipifera*, *Sequoia sempervirens*, Banana tree, *Chamaerops humilis*, *Afrocarpus falcatus*, Dragon tree (*Dracaena draco*), *Araucaria angustifolia* and *Araucaria bidwillii*, Cedar (*Cedrus deodara*), Strangling fig (*Ficus macrophylla*), Magnolias, *Ficus pumila*, Yam (*Colocasia esculenta*), are species to meet.

This multidisciplinary project promotes literacy and new pedagogical tools. Meeting curricular goals of different Portuguese school grades and subjects (6th grade - history and geography of Portugal; 8th - history; 10th - history B; 11th - history A, history B, history of culture and arts; 12th - history A), it also generates a tourist opportunity for diverse audiences at the JBUC, a UNESCO World Heritage Site since 2013.

KEYWORDS: education; green spaces; statues; heritage; literacy; science; tourism.

INTRODUCTION

The Botanical Garden of the University of Coimbra (JBUC) arises in the context of the Enlightenment, that is a philosophical current that developed in Europe during the eighteenth century and that defended ideals such as freedom, progress, tolerance and the separation between State and Church (Brites, 2006; Tavares, 2011; Tavares, 2012). According to the Enlightenment, only reason, combined with the scientific method, could guarantee the progress of knowledge. Portugal, in the second half of the 18th century, was a country where the Enlightenment had not yet arrived. The Inquisition persecuted all those who defended the new ideals and teaching remained dominated by the Society of Jesus, which refused to integrate experimental teaching and scientific discoveries (Fiolhais, 2010). Foreigners were the great disseminators of Enlightenment ideas in Portugal, were Portuguese who had lived abroad and contact with this progress, intended to implement it here, as the Marquis of Pombal. As prime minister of King D. José I, Pombal is considered one of the greatest statesmen of the eighteenth century. He marked the reform of University education by creating institutions

dedicated to experimental teaching, being an example, to this day, the Botanical Garden of the University of Coimbra (Almeida, 2014; Reis & Trincão, 2014; Tavares, 2015b). Vandelli, an Italian naturalist from Padua, arrived in Portugal in 1764 by the invitation of the Marquis, and was the first Director of JBUC from 1772 to 1791 (Cabral, 2018; Marques, 2009). He maintained communication with eminent scientists of his time and between 1761 and 1764, exchanged correspondence with the Swedish naturalist Carl Linnaeus, considered the "father of taxonomy", recognized worldwide for the creation of binomial nomenclature and scientific classification, still used today. Linnaeus greatly appreciated the work of Vandelli, and paid tribute to him, dedicating a genus, the *Vandellia*, of the family of Scrophulariaceae (Henriques, 1876). It was Linnaeus, his biggest influencer, who encouraged him to come to Portugal for the advantages over scientific discoveries undergoing in a country with tropical colonies (Chaves, 2009).

The goal of this study is to improve the accessibility and the knowledge of the History of the Botanical Garden of the University of Coimbra, as well as the biography of its Directors and their main contributions. The specific objective is to create an educative itinerary for all audiences, and that also fulfils the learning goals of different Portuguese levels of education.

MATERIAL AND METHOD

Welcoming the visitors when arriving to the Garden is the first step of the interpretative tour, along with the introduction of the guide, the JBUC institution and the thematic goal. This introduction ends with the presentation of a pamphlet, as follows. The definition of Botanical Gardens is presented, as places with collections of living plants used to research, conservation, exhibition, education and to be appreciated by the public. Then the presentation about the JBUC begins. This Botanical Garden was created in 1772, about 20 years after the great earthquake of Lisbon (1755) by order of Marquis of Pombal, being the 2nd oldest botanical garden in Portugal and one of the oldest in Europe. At first it was confined to the terrace designated Central Square, whose flower beds contained living collections for the teaching and knowledge of botanical specimens, particularly with medicinal interest, for the classes of pharmacy and medicine students. Over time, the JBUC annexed several plots of land around it, mostly given by religious orders, and currently has about 13 hectares, of which, about 4 hectares form the classic garden and the remaining 9 hectares relate to the arboretum. The neoclassical style and its main features are clearly visible in the classical garden, by the organization on terraces and boulevards, with stone walls and wrought iron gates. JBUC has been classified by UNESCO world heritage site since 2013. In this interpretative tour will be privileged the History of JBUC through the statues of its Directors and other architectural elements, project that was produced in the framework of the 2019/2020 edition training course: "Knowledgeable interpreter of the Botanical Garden of the University of

Coimbra". Based on the structure of the educational actions of the Garden Educational Program presented at the Course, a new garden content entitled "The History in the stones of the Botanical Garden of the University of Coimbra" was proposed. Fitting to all audiences, the contents are particularly directed to school groups (up to 25 people per group), starting from the 6th grade, with special interest to the secondary school students.

RESULTS

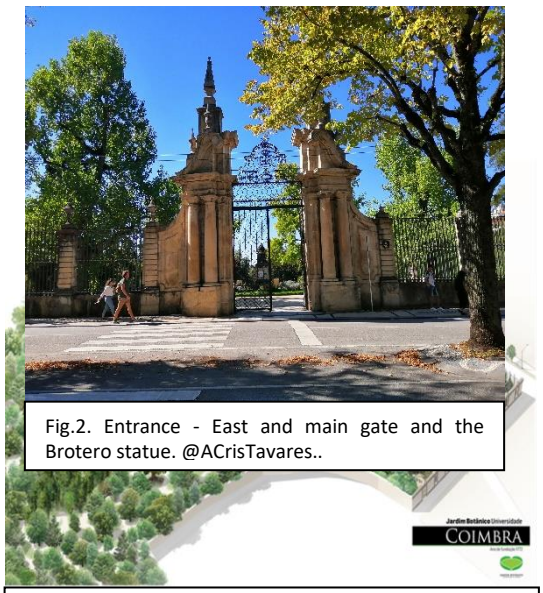

Fig.2. Entrance - East and main gate and the Brotero statue. @ACrisTavares..

Fig. 1. Garden Map with Five Main stops points. 1. East gate (Brotero statue); 2. Júlio Henriques Terrace (Tropical greenhouse); 3. Júlio Henriques Terrace (Statue); 4. Lake Luís Carriço: 5. Central Square. Garden Map in:

The key product of this work is this pamphlet itinerary with main contents and the reference of **5 special moments of stop**. According to the Garden map **(Fig.1)**, **the itinerary starts in the east gate (Figs. 1 and 2) at the Brotero statue (Fig.2) - 1st Stop.**

The main gate, of neoclassical style, was completed in 1844 and is authored by Manuel Bernardes Galinha. Made of wrought iron, with bronze applications, it is one of the five gates of JBUC. The portico that frames it was completed in 1839 and is authored by José Santos Leal. The marble statue of Brotero (**Fig. 3**) was created by Soares dos Reis in 1887 and it is the first Portuguese statue dedicated to a scientist.

Félix Avelar Brotero studied in Paris. In 1791, Queen Maria I appointed him Director of JBUC and regent of Botany and Agriculture at the University of Coimbra. He was the 1st JBUC's Portuguese Director until 1811, and who first publish (1804) a Portuguese flora, the "Lusitanic Flora", a catalogue with the description according to Linnaeus's system of more than 1,800 different plant species of Portugal (now there are about 4,000). The space was essentially designed for the study of medicinal plants. Brotero restructured JBUC installing the Systematic Schools for botanical and agricultural study, on the superior terraces. **Species of interest** near: *Ginkgo biloba, Liriodendron*

Fig.3. Brotero statue, *Ginkgo biloba* and *Liriodendron tulipifera* trees. @ACrisTavares..

tulipifera **(Fig.3)**, *Sequoia sempervirens, Chamaerops humilis, Cycas revoluta.*

Continuing through the Júlio Henriques Terrace to the Tropical greenhouse. 2nd Stop (Fig.4). The main Greenhouse, was

Fig.4. Greenhouse at right, central avenue with *Cedrus deodara* (tal tree at right), and Sistematic Schools at left side. @ACrisTavares.

completed in 1865, under the Direction of

Henrique Couto d'Almeida, who was the 12th Director of JBUC (1854-1867). He was responsible for the construction of large water reservoirs, indispensable to irrigation, and for the greenhouses, two small support greenhouses, one for the multiplication of plants and the other reserved for crops with greater specificities.

He delegated in the Azorean José do Canto, a specialized gardener, the search for plants and the culture work in the

Fig.5. Main Greenhouse. @ACrisTavares.

main Greenhouse. The Greenhouse Project was offered to the University in 1854, by Pedro José Pezerat, French engineer and architect. The JBUC's Greenhouse was completed in 1865, ten years after it was started, being one of the first constructions of iron and glass architecture in Portugal. It is divided into three sections **(Fig.5)**, which replicate tropical, subtropical and temperate climate. In 1866, Edmund Goëze, one of the leading gardeners at the Kew Botanic Garden in London, accepted the position of head gardener at JBUC and set out on a botanical expedition to the Azores where he gathered about a

Fig.6. Julio Henriques terrace and main Greenhouse at left. @ACrisTavares.

thousand species for the new JBUC Greenhouse in just six weeks. He also established contacts with foreign gardens for exchanges and donations of plants from various locations around the world such as Europe, Africa, Brazil, or Australia. In 2013 it was announced the project of requalification of the Greenhouse, under the QREN, being authored by architect João Mendes Ribeiro. **Species of interest** near: *Quercus* spp.; *Platanus* spp.; *Afrocarpus falcatus*.

Continuing through the Júlio Henriques

Fig.9. D. Maria I gate, east entrance to the Central Square terrace. @ACrisTavares.

Terrace **(Fig. 6)** to the **Júlio Henriques statue** (**Fig. 7**) - **3rd stop.** He was JBUC's Director for 45 years (1873-1917). In 1873 he was assigned the regency of the Botany and Agriculture subject. He finished Alameda das Tílias and restructured the Central Square (about 100 years after the foundation of JBUC), as it presents today, with symmetrical and concentric beds in relation to the central lake. **Species of interest** near: *Dracaena draco, Afrocarpus falcata, Ficus pumila, Ficus macrophylla.*

Going down the stairs to Luís Carriço lake (Fig. 8) - 4th stop. Director of the

Fig.8. Luis Carriço Lake. Present: *Colocasia esculenta, Doryanthes palmeri, Jasminum mesnyi, Strelitzia elatior.* @ACrisTavares.

Botanical Institute that included Museum, Herbarium and JBUC (1918-1937). He created the School of Monocotyledons in the Arboretum. Contributed with many specimens to the collection of African plants,

Fig.10. Central Square terrace, with central Fountain. @ACrisTavares.

Fig.7. Julio Henriques statue, two *Dracaena draco* back and each side. @ACrisTavares.

increased JBUC's accessible area and introduced into the small greenhouse the culture of *Victoria amazonica*, the largest water lily in the world.

Species of interest near: *Colocasia esculenta, Doryanthes palmeri, Jasminum mesnyi, Strelitzia elatior.*

Entering by the Portico of D. Maria I **(Fig. 9)**, built in 1791, it is the oldest entrances gate of the Garden. Gives access to JBUC's "cradle terrace," Central Square, via a staircase, the **ending point - the Central Square (Fig.10) - the oldest terrace in the Garden - 5th Stop.** The Latin inscription,

at the top of the portico honors the Queen Maria I for supporting the teaching of science during her reign. Initially there was a lake in the center, which still exists today, and around sixty rectangular beds with plants distributed and organized according to the taxonomy of the Swedish naturalist Carolus Linnaeus, intended for the practical study of medical and botanical students, being the first lessons of Botany to the students of the University of Coimbra performed here, at The Central Square. This configuration remained for about a century. In 1891, the then Director Júlio Henriques began

Fig.11. *Cryptomeria japonica* (the tallest tree) and *Eritrina crista-galli* (red flower in ampliation): the oldest trees, with more than 200 years old. @ACrisTavares.

a reformulation of the Central Square. The objective was to place the species in order to represent the various botanical regions of the Terrestrial Globe. In the new upper terraces were installed the collections of the Medical School and Schools of Systematics. In the Central Square new symmetrical and concentric beds were built with the central lake. This beds received essentially ornamental plants, many of them also with symmetrical arrangement to each other. Most trees are deciduous and so the Central Square looks different each season.

In 1945, the last refurbishment of the Central Square took place, approved by Director Abílio Fernandes, which focused on aesthetics. The transformation went through surrounding the beds with *Buxus* sp. plants hedges, creating turf areas and planting flowers. It was also restored the gates and the stairs of the Central Square, and the bridge of access to the Forest was also built. The works ended in 1949 with the placement of the fountain in the central lake. In the Central Square is located the mural plaque in honor of Domingos Vandelli, Italian naturalist and first Director of JBUC who, with Dalla Bella, concretized the project of this Garden. We invite you to discover!

In 1945 took place the last renovation of the Central Square, the staircase, the gates, and the flower beds were surrounded by hedges of *Buxus,* and the stonework was restored under the Directory of Professor Abílio Fernandes (1942-1974). The fountain was placed in the central lake. **Species of interest** near: *Erythrina crista-galli* **(Fig.11)**, *Cryptomeria japonica* **(Fig.11)**, *Fagus sylvatica, Liquidambar styraciflua, Acer spp, Magnolia spp.* **(Fig.12)**.

On this terrace, seasonality is well marked in the different species present, which bloom at different times of the year **(Fig.12)**, giving greater beauty, attractiveness and specificity to the terrace of the Central Square.

DISCUSSION

Education in Botanic Gardens is an instructive practice that simplifies and

enrich the natural sciences teaching-learning process and the level of literacy, in general. Studying in a truly living environment space, educational activities in the garden are guaranteed dynamic and very enriching for the immense availability of educational resources, real models that are genuine examples, exciting and often surprising (Espírito Santo, 2021; Reis et. al, 2014). These represent real opportunities to choose and adapt the living examples and other kind of patrimony, especially in Historical Botanical Gardens, as the BGUC. The almost 250 years of the Garden, to be reached in 2022, offer a panoply of living collections and physical patrimony elements, that mirror an immensity of knowledge and are examples that can be vehicles for learning, focusing different disciplines and audiences.

In this context, fulfilling the scope of curricular essential learnings, the contents presented and that will be developed during the 90 minutes time predicted for the interpretation visit, aims to fulfil the goals of different grades, as follows: 6th grade-History and Geography of Portugal: Characterize the centralizing action of the Marquis of Pombal and the innovative character of some of its policies. Understand the action of foreigners and the Marquis of Pombal in the context of Enlightenment thought. 8th grade, History: Identify/apply the concepts: Scientific revolution; Enlightenment; Foreign. 10th grade, History B: Identify/apply the concepts: Enlightenment. 11th grade, History A: To value the contribution of the progress of knowledge and the affirmation of the philosophy of lights to the construction of European modernity. Identify/apply the concept: Enlightenment. History B: To argue that the economic policies of the New State obeyed ideological-political imperatives such as public works. History of Culture and the Arts: Recognize in neoclassicism the triumph of Enlightenment conceptions and a desire to return to the classical order, expressed in principles of moderation, balance and idealism, identifying some contributions of neoclassicism in Portugal.

12th grade, History A: Portugal: the "Estado Novo". To understand that economic policies have obeyed ideological-political imperatives such as public works.

Nevertheless, depending on the preferences, preparation, and intentions of the participants, general knowledge in a lighter speech can be performed, to accomplish a comfortable dialogue and tour, even with no specific scholar objectives of learning. Also, a touristic perspective of a Garden view is always welcome and is under the scope of the institution's main mission: to be open, well receive and have answers and particularities to all publics and

Fig.12. *Magnolia x soulangeana* blooming, only present at winter time, special during February month. @ACrisTavares.

audiences, including people with special needs (Tavares, 2015a).

Portuguese school grades and subjects: 6th grade - history and geography of Portugal; 8th - history; 10th - history B; 11th - history A, history B, history of culture and arts; 12th - history A.

Also, within the scope of the Historic Gardens, this proposal generates a tourist opportunity for diverse audiences at the JBUC, highlighting one of the few Botanical Gardens in the World that is considered UNESCO World Heritage Site, since 2013.

CONCLUSION

The objectives initially proposed are well achieved. In reality, this multidisciplinary educative action promotes literacy for all kind of audiences, and presents a pedagogical and training tool, not to be wasted, meeting curricular goals of different

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TRIED, TESTED - OPPORTUNITIES FOR PRIVATE BOTANICAL GARDENS IN THE TOURIST INDUSTRY

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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 sixteen 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 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 species of pines altogether.

The garden is still privately owned by the Folly family as opposed to the majority of other botanical gardens in Hungary and other ex-communist countries that are stately owned, or university affiliated.

A historical botanical garden, however well-kept and beautiful, can only attract a limited number of visitors solely by the merit of the plants it cultivates and the walkways it maintains. It requires much more effort to reach the crowds. Our philosophy revolves around the notion that the garden – above and beyond being just a collection if rare or valuable plants - must be provided as a beautiful backdrop to activities of everyday life. My presentation details the method and the ideas behind creating a buzzing tourist attraction. Some key points:

- existing strengths to build upon (location and panoramic views in our case)
- widening our reach (families with kids, wine enthusiasts etc)
- programs (guided tours, childcare with activities)
- branded quality products, some manufactured on site
- availability as a venue for special occasions (weddings, class outings, team building etc)
- strong presence in social and traditional media

Eleven 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 philosophy 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, tourism, visitors

TELLING STORIES ABOUT ENDANGERED PLANTS IN A GARDEN: CREATING LAST CHANCE VISITATION EXPERIENCES USING MAPS AND STORYTELLING[i]

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Our research stems from the idea that narratives and geography can be integrated into a garden visitation experience through story mapping. Story maps use geographical contents to organize and present information. They can tell the story of a place, event or issue by combining interactive maps with contents like photos, texts, illustrations, video and audio. While maps can provide powerful visual representations, storytelling carries the potential to effect change, influence opinions and create awareness.

Considering the growing relevance that urban nature has assumed in the creation of more sustainable territories, we created an eco-fiction mixed-reality game – *Origenes Botanica* - using the story mapping software ESRI StoryMaps. The game is set in a futurist scenario: in 2100, climate change and ecosystem degradation has led to the disappearance of several plant species in the wild. One place, the Ajuda botanical garden in Lisbon, preserves specimens from various parts of the world that are threatened with extinction, the result of human action and the period of great acceleration that occurred from the mid-twentieth century. The user is part of a group of researchers that visits the garden and follows a virtual route through the five continents seeking plants and trees in each of these spaces. In a dialogue between virtual characters and with the support of illustration, the objective of the game is to make visitors aware of the dangers of biodiversity loss and to create, through storytelling, an artificial last-chance travel experience to visit and meet endangered species. Garden visitors will have access to information such as the description of the species, its place of origin, the cause of the threat of extinction and the places where they are endangered.

Keywords: Garden Visitation; Endangered Species; Storytelling; Mixed-Reality; Story Maps

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SHORT PRESENTATIONS

THE NATIONAL GARDEN OF ATHENS AS A BOTANICAL RESOURCE FOR THE CITY

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Abstract:

The National Garden in Athens constitutes a Historic Garden with strong Botanical orientations since its creation. It used to be a Royal Garden that Queen Amalia envisaged in 1836 to surround her Palace symbolising the establishment of the modern Greek state by the Bavarian royalties. It was designed following English style landscape designs of the time, with meandering paths and opening views to the surrounding landscape and antiquities. The efforts put in for the completion of the Garden reaching almost its current size (15 hectares) were unprecedent for the country, considering the poor available means the newly established state could provide. Trial and error techniques were widely used by all specialists involved at the time: the famous Bavarian botanist Karl Nikolas Fraas, the French Landscape architect Francois Luis Barauld, the Bavarian agronomist Frederick Smidt. Indigenous tree species were introduced travelling from all over the country (such as *Quercus ilex, Cupressus sempervirens, Ulmus campestris, Platanus orientalis)* but also a great number of exotic plants were notoriously shipped from abroad (such as palm trees like *Phoenix canariensis, Washingtonia robusta, Livistonia chinensis* and other ornamentals like *Melia azedarach, Koerleuteria paniculata, Schinus molle).* Many of the species that form the landscape of the parks and streets of the City of Athens were introduced during that era.

The arid Athenian climate was harsh on plants and water hard to obtain. However, the water found from the ancient underground Peisistratus Aqueduct constituted and remains the main source of irrigation of the Garden. A wise system of surface channels running through the Garden from its highest to the lowest part forms its backbone ingredient and the reason of its existence until today.

The Garden became public in 1927 and was designated as a Historic landscape by the Ministry of Culture in 2011. It is now managed by the City of Athens and the newly created city-owned company, Green Athens SA. and participates in the National Network of Greek Botanic Gardens.

Keywords: Athens National Garden, historic garden, royal garden, botanic garden

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ANALYSIS OF ORNAMENTAL FLORA IN THE LA CONCEPCIÓN HISTORICAL BOTANICAL GARDEN IN THE 19TH CENTURY

BLANCA LASSO DE LA VEGA WESTENDORP

La Concepción Botanical and Historical Garden, Málaga, Spain.

In the second half of the 19th century, the city of Malaga saw exceptional growth in the number of gardens and in the plant diversity they were home to. This was influenced by the economic boom of the bourgeoisie, the fashion for collecting and the new communications. The singular fondness for plants and gardens led to contests, exhibitions, and the acclimatisation of rare exotic species. Numerous professionals (gardeners, nursery specialists and women, horticulturists, and engineers) came from abroad to practise, horticultural establishments multiplied, and businesses related to botany and gardening thrived. This also led to a change in Malaga's appearance, with the city becoming «greener» and healthier, in addition to gathering in its gardens a plant complexity that was surprising for the period.

One of the first gardens of the time was the garden of La Concepción, the result of a cluster of successive social, cultural, political, and artistic events that have favoured its development and survival to this day. Among them was the rise of the bourgeoisie in Malaga in the 19th century, which, together with the political and financial power they sustained, the taste for the European style, the collecting, and the fashion for the exotic, promoted the building of large villas with gardens on the outskirts of the city where species from various parts of the world were cultivated, endorsed by the Royal Order of 1863 issued by Isabel II for the acclimatisation and enhancement of foreign species.

The construction of the garden began in the second half of the 19th century as the result of the marriage between Jorge Loring y Oyarzábal, engineer, merchant, and politician, and Amalia Heredia Livermore, daughter of one of the most influential men in the city at that time. In Europe, the hacienda became known from its beginnings for the magnificent collection of archaeological remains gathered by its owners, and which were the subject of study by prestigious researchers of the time.

Year after year, the introduction of numerous warm-climate plant species took place, because as was the case in other parts of Europe, the fashion of the exotic had arrived in the city. This plant enrichment had different origins. To find out about the flora existing in La Concepción, historic and current texts that refer to them or to the garden have been gathered. The engravings, postcards, and images from 1861 (the oldest found) to 1930 have been studied, as well as the chapter records, files and press of the time.

Keywords: Historical gardens, plants acclimatisation, Ornamental Flora, La Concepción, XIXth.

CITY DEVELOPMENT AND ITS IMPACT ON THE ENVIRONMENTAL CONDITIONS AND FUNCTIONINGOF THE BOTANICAL GARDEN OF THE ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ (POLAND)

JOANNA JASKULSKA, MONIKA RĘKOŚ, MATEUSZ SOWELO

Botanical Garden of Adam Mickiewicz University in Poznań, Poznań, Polland

Abstract:

The Botanical Garden of the Adam Mickiewicz University in Poznań was established in 1925 and at that time it was located on the outskirts of the city, surrounded by horticultural and agricultural lands. Initially, it occupied an area of approx. 2.5 ha, but over the years, it was expanded several times to fulfil the needs of developing collections. Currently, the area of the Garden is approx. 22 ha and further enlargement of the premises is not possible since it is surrounded by public roads on all sides.

The aim of this poster is to present that progressive urbanization has generated several factorsthat have a significant impact on the environmental conditions in the Garden as well as on the wayit functions. Over the past decades, because of the development of the city, the borders of Poznańhave been constantly expanded.

One of the most significant problems resulting from increasing urbanization is constant lowering ofgroundwater levels. This factor, in combination with cyclically occurring meteorological drought in Poznań (as in the whole region of Greater Poland), generates stressful conditions for plants in the collections, especially for woody plants.

Additionally, increasing noise pollution influences many aspects of the functioning of the garden. It,inter alia, discourages visitors from exploring the collections, adversely affects their leisure and makes it difficult to conduct educational activities. The lack of possibility to further expand the areaof the Garden poses another problem for the constantly developing and expanding collections.

Although the development of the city has unquestionably a negative impact on the environmental conditions in the Garden, it has also some positive effects on its functioning. For example, due to the well-developed public transport network in the city, the number of visitors has increased.

From the beginning of its existence, the Garden was a place for recreation and leisure for the inhabitants of the continuously expanding city. Due to, among others, established cooperation withthe city's authorities and local communities, the Garden has broadened its role. Because of continually developing educational infrastructure, each year more trips for preschoolers, school children and seniors are being organized. Moreover, over time, the Garden has become not only a center of cultural events and social interactions but also a green enclave for animals searching for food.

The specific environmental conditions in urban agglomerations have been an important topic of discussion in the world of science in recent years. The changes in the last decade have given rise adjustments in the resource management and skillful planning of further activities so that theBotanical Garden can function effectively and fulfill its targets for the next decades.

Key words: urbanization, environmental conditions, groundwater level, noise, meteorological drought

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COLLECTION, DOCUMENTATION AND *EX SITU* CONSERVATION OF GREEK NATIVE FOREST FRUIT TREES AND SHRUBS

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Fruit and shrub crops are an important sector of crop production. In recent decades domestic genetic material has been displaced by imported. Therefore, the conservation of indigenous genetic material is of utmost importance as there is an abundance of genotypes with special taste and cultivation characteristics as well as resistance to various stresses. Balkan Botanic Garden of Kroussia (BBGK), N. Greece, maintains about 7,000 species, constituting an excellent source of genetic material. Within the framework of the EcoVariety research project, 8 different wild-growing native forest trees and shrubs species *from northern Greece (124 accessions)*: *Amelanchier ovalis (9 accessions)*, *Cornus mas (23 accessions)*, *Prunus spinosa (15 accessions)*, *Rhus coriaria (12 accessions), Rosa canina (14 accessions)*, *Rubus idaeus (20 accessions)*, *Sambucus nigra* (14 *accessions*) and *Vaccinium myrtillus (16 accessions)* were collected. One accession of *A. ovalis,* two accessions of *P. spinosa and* two accessions of *R.canina* are maintained in BBGK. The project's aims were to document these species in their habitat, to collect several samples from different sites, to develop asexual propagation protocols and ultimately apply this knowledge to pilot crop cultivations. Propagation trials for each collected population of each species have been established in the laboratory of the Institute of Plant Breeding and Genetic Resources of ELGO Dimitra. *S. nigra, C. mas, R. canina* and *R. idaeus* responded well to the application of the selected rooting hormone (IBA) and the tested treatments presented higher rooting rates compared to the control (P<0.05). Contrastingly, *P. spinosa, R. coriaria* and *A. ovalis* presented comparatively lower rooting rates. All propagated plants have presented good adaptability at the *ex-situ* environment of Balkan Botanic Garden in Thermi, Thessaloniki, where currently are being cultivated successfully in pilot fields. Regarding *S. nigra* the 19.479 population had the highest growth rates compared to the other eight established plant populations ($P<0.05$) and four out of the nine populations bloomed 20 days earlier. All populations of *C. mas* did not show particular growth in

contrast to four established populations of *R. canina* plants that adapted perfectly and yielded. All populations of *R.canina* followed the same pattern and had similar growth rates (*P>0.05*). *R. coriaria* and *P. spinosa* showed to adapt quite well, without significant yield. Hence, this study can be the springboard for the commercialization and sustainable utilization in future breeding programs of Greek native population genotypes of wild-growing fruit species.

Keywords: native plants, wild-growing fruit species, preservation, asexual propagation, Botanic Garden

Acknowledgments: This research has been co-financed by the European Regional Development Fund of the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T1EDK -05434, acronym: EcoVariety).

THE SUCCULENT COLLECTION OF THE BOTANICAL GARDEN OF THE UNIVERSITY OF ADAM MICKIEWICZ IN POZNAŃ

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The Botanic Garden of the Adam Mickiewicz University in Poznań was established in 1925. However, the first greenhouses, with a total area of 500 m^2, was built just in the second half the 1950s. and extended by the next 250 m2 in the 1960s. Here began the collection of tropical plants including succulents. Collection was stared thanks to international exchange of seeds with other European and world greenhouses, gathering seeds and plants from the other research units in Poland and Europe, and thanks to contacts with private collectors.

The oldest dated specimens of coarse plants come from 1957. However, the development of collection and detailed documentation has begun in 1970s. and the largest number of specimens has been gathered in 1980s and 1990s. The first electronic database was established in 1999, which was expanded and modernized in the following years.

Currently the UAM Botanic gardens succulents' collection is placed in three greenhouses of a total area of 250 m^2 in various microclimatic conditions. Despite a

little area, a variety of tropical species have been collected here in number of over 1000 *taxa* from 200 genera and 34 botanical families. The most numerous representatives come from *Cactaceae*, *Crassulaceae* and *Aizoaceae* families. Plants gathered in the collection of succulents represent all types of morphological and anatomical structure, show the adaptation of plants to drought in natural conditions, help to understand the phenomenon of convergence. Thanks to this, the collection is used in academic teaching and broadly understood general education.

At the time when the collection of succulents in was created, it had a very extensive terminology. Many years of research by a group of experts caused changes in the nomenclature of this group of plants at the beginning of the 21st century („The Cactus Family" – E.F. Anderson, 2001 and Illustrated Handbook of Succulent Plants" - U.Eggli, E.K.Hartmann and others, 2001-2003). The introduction of changes in the names of genera and species required taxonomic verification of all plants in the collection. The biggest changes in our exposure concerned the *Cactaceae* family. Organizing plant names required a lot of work, changes in the database, changing labels, and in our mentality.

Managing the collection of succulents therefore requires constant substantive supervision, highcommitment of employees dealing with the care, access to current literature and online databases, and the exchange of information with other botanical gardens.

Key words: succulents, plants collection, greenhouses

O CHÃO DAS ARTES – BOTANICAL GARDEN, CASA DA CERCA - CONTEMPORARY ART CENTRE

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ABSTRACT
In 1988, when the property was acquired by Almada City Council it was an unremarkable cultivation space, overgrown with weeds and flowers and punctuated by a few fruit trees.

Surrounded by walls on all sides, the gentle topographic slope of the site towards the north provides a view over the Tejo valley.
The garden is accessed from adjacent spaces and the house by gates, reinforcing its isolated, almost autonomous, character.
The garden is based on an approach to the visual arts, but one which goes beyond the final artistic product to focus on the origin of the materials used in artistic practices. In this context, *O Chão das Artes* - Botanical Garden is unique in its joint articulation of the scientific and the artistic approaches.

With a total area of around half a hectare, the Garden opened to the public on 9 June 2001 after three and a half years of work, offering visitors an original approach to the visual arts. Since that date, the Contemporary Art Centre and the Botanical Garden have worked together to explore, research and disseminate the connections between Art and Science.

As of 2021, the Garden has a collection of over two hundred species that are maintained, promoted, studied and explored through the prism of the materials these same plants produce.

The Garden is divided into various areas:
Pigments' Garden, Gum Orchard, Oil's Garden, Fibres' Garden, Woods, Painters' Garden, Pond and Greenhouse. Figure 1, 2, 3 and 4.

Figure 1 - Master plan 2021

KEYWORDS: Art and science, raw materials, visual arts materials, art supplies, gardening, plant collection, ethnobotany

Figure 2 - Aerial view (1993)

Figure 3 - Aerial view (2000)

Figure 4 - Garden's parcial view (2003)

INTRODUCTION

We present a Garden – *O Chão das Artes*, with 20 years of existence, which was conceived as a complement to the Contemporary Art Centre, opened in 1993. This Contemporary Art Centre appears in a 18th century manor house, the main building of a recreational farm – Quinta da Cerca, situated on the cliff, on the south side of the Tagus River, in front of Lisbon.

Art is both the main source of inspiration and the main protagonist of *O Chão das Artes* – Botanical Garden,

which has a mission to explore the connections between Art and Science through research and dissemination of its collection of plants, that are raw materials for the manufacture of visual arts supplies.

The vision of this Garden is to promote knowledge of plants from around the world (though with a particular emphasis on Europe) that have been used to provide raw materials for artistic practice throughout history

MATERIAL AND METHODS

In 1997, an idea arose to make a different garden, around the Contemporary Art Centre, with a special thematic concept, where art would become the prime motivation of the project. The garden is based on an approach to the visual arts, but one which goes beyond the final artistic product to focus on the origin of the art supplies. In this context, *O Chão das Artes* - Botanical Garden is unique in its joint articulation of the scientific and the artistic.

The Contemporary Art Centre and the Botanical Garden have worked together to explore, research and disseminate the connections between Art and Science.

While the vegetation is the main protagonist, as in any garden, here it acquires an added layer of meaning, not only in terms of the didactic-scientific nature of the Botanical Garden, with the identification and classification of species, but also in terms of a curation of plants determined by the theme of the visual arts.

To respond to this specificity, references to plant materials were sought in historical methodologies and treatises on painting, such as those of Cennino Cennini (c. 1400), Filipe Nunes (1615) and Leonardo Da Vinci (1632), while ethnobotanical research identified plants used as raw materials for artistic creation. This research was then cross-referenced with the edaphoclimatic characteristics of the region and with the wind and atmospheric salt conditions of the site.

Planting plans were devised and implemented in 2001 and revised in 2011, when a decision was made to incorporate species traditionally used in dyeing processes, and also vegetal papers, oils, basketry,… thus vastly expanding the number and types of plants on the site.

As of 2021, the Garden has a collection of over two hundred species that are maintained, promoted, studied and explored through the prism of the materials these same plants produce.

RESULTS

O Chão das Artes - Botanical Garden, with almost half an hectare, is divided into various areas:

The Greenhouse is an exhibition space where art and science intersect, reflecting research being carried out

both in the Botanical Garden and in the Contemporary Art Centre.
Housing some plants from the Garden's collection that cannot be kept outside due to their soil and climatic requirements (such as indigo, Indian saffron, pineapple). The Greenhouse was designed in the image of a trellis, inspired by the rhythm of the trellis running along the garden's north wall. Figures 5 and 6.

Figures 5 and 6 – Garden´s main entrance (2001 – 2021)

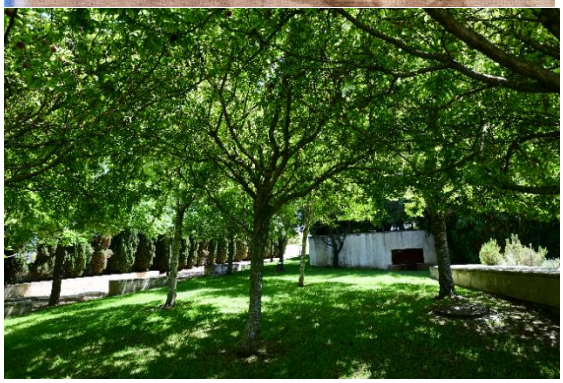
Adjacent to the Greenhouse**, the Pigments' Garden** features herbaceous and shrubby plants used in the production of many colours used in artworks. Here we find the plants from which pigments and dyes are extracted for the production of paints, inks and dyes for natural fibres. Figures 7 and 8.

Figures 7 and 8 – Pigments' Garden (2001 – 2021)

The Gum Orchard is consisting of fruit trees, mainly of the genus *Prunus*. A gum similar to gum arabic can be extracted from their trunks and used in various painting techniques. This gum is used as a medium for diluting pigments or as a glue.
When burnt, the hard shells of almonds and walnuts and the stones of peaches, plums, cherries and apricots can be used to make type of a black paint: charcoal black. Figures 9 and 10.

The Oils' Garden features plants whose seeds are processed into the oil paints, emulsions and primers used in various schools of European painting.

Linseed oil, extracted from flax seeds, is widely considered to be the best of these oils, though poppy seed oil was



Figures 9 and 10 – Gum Orchard (2001 – 2021)

also much appreciated by the impressionists for its thickening properties, creating brush strokes that were particularly evident. Figures 11 and 12.

The Fibres' Garden destined to plants that produce fibres from which paper, fabrics for canvas and rope can be made. Figures 13 and 14.

The Woods is the area of the Garden where visitors can find large trees and shrubs from which two types of important materials for artistic production can be extracted: the wood used in sculpture and as a support for panels, altarpieces and canvases; and resins for the production of turpentine and varnish. Here we find some of the species most commonly used in European schools of painting, such as chestnut, poplar, birch, maple, horse chestnut, ash, several species of oak, and several coniferous trees such as cedar, fir and maritime pine, whose resin is an important source of turpentine, known and used since antiquity. Figures 15 and 16.

Figures 11 and 12 – Oils' Garden (2001 – 2021)

The Pond is a wetland area that hosts species that need a moist substrate all year round. Most provide materials for papermaking (lilies, paper reeds, cattail reeds and others), but some can also be used for making dyes or pigments (redshank, water lilies, horsetails, ferns and giant rhubarb).

Ephemeral in nature, **the Painters' Garden** is essentially intended to honour specific artists. It is the most dynamic and creative area of the garden and its planting plan is reformulated every year. Garden projects are designed with reference to selected artists whose work is in some way


Figures 13 and 14 – Fibres' Garden (2001 – 2021)


Figures 15 and 16 – Woods (2001 – 2021)

related to the annual programme of the Contemporary Art Centre and its activities and mission.

In 2021, on the 20th anniversary of *O Chão das Artes* - Botanical Garden, we celebrated the colours generated by plants by creating a natural palette. Inspired by the work of Johannes Itten (1888-1967), the planting plan was conceived as a large box of watercolours whose colours are derived from the plants found in this collection and used to produce dyes. Figures 17 and 18.

Figure 17 – Painters' Garden (2000)

Figure 18 – Painters' Garden (2021)

DISCUSSION

In 2019, *O Chão das Artes* – Botanical Garden was visited by 75,000 people. In addition to orientated visits by specialized technicians (Figure 20), activities were developed for audiences of all ages, based on the Garden and exploring Art and Science, namely: "Garden's Friends"- a volunteer program for the maintenance of the garden (Figure 21), "May at the Garden" – program of ethnobotanical exploration of the plant collection: plant papermaking workshop, papyrus manufacture, traditional and alternative plant dyeing techniques, (Figures 22, 23 and 24) vegetal ink production (Figure 25); "Garden's workshops" – program of theoretical-practical conversations about plants, their importance in the history of art and gardens; "Workshops to families" – a program of transversal exploration of the Garden especially dedicated to parents and children (manufacture of bamboo nibs, vegetable weaving, manufacture of seed paper, dyeing bags, manufacture of charcoal pencils) (Figure 26); "Free-drawing sessions in the garden" (Figures 27 and 28), exhibits (Figure 29), among many others. Over these 20 years of careful maintenance investigation and engagements activities with special attention about garden interpretation, we believe to be contributing to the enhancement of gardens, gardens in historic spaces, botanical gardens and their plant collections, as well as to a broader knowledge of plant material and its uses in Art and Science.

CONCLUSION

The Botanical Garden presents a plants collection as living material, but also offers complementary information that provides a deeper understanding of each species in terms of botany,

horticulture, ethnobotany, fine arts, art history and the history of gardens.

Art is both the main source of inspiration and the main protagonist of *O Chão das Artes* – Botanical Garden, which has a mission to explore the connections between Art and Science through research and dissemination of its collection of plants, many of which are raw materials for the manufacture of visual art supplies.

Figure 19.

Figure 19. Aerial view 2021

Figure 20 – Oriented visit

Figure 21 – Garden's Friends

Figure 22 – Workshop "Yellow dyes"

Figures 23 and 24 – Plant dye workshops

Figure 25 – vegetal ink workshop

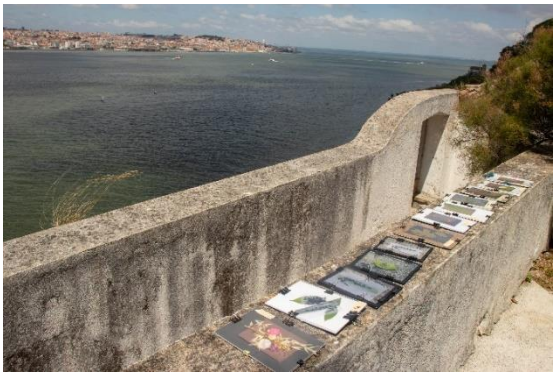


Figure 26 – workshops for families

Figure 27 and 28 – Drawing sessions

Figure 29 - Exhibits

BOTANICAL GARDENS OF UKRAINE IN HISTORICAL RETROSPECTIVE

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Abstract:

The history of creation of botanical gardens in Ukraine dates back to the beginning of the 19th century. The Botanical Garden of V. N. Karazin Kharkiv National University, founded in 1804, is the oldest botanical garden in Ukraine. Itis followed by the other old botanic gardens, such as Kremenets Botanical Garden (1809) and Nikitsky Botanical Garden (1812). In 1839, O.V. Fomin Botanical Garden was founded, initially subordinated to the Imperial University of St. Volodymyr (1834–1919) (now Taras Shevchenko National University of Kyiv). Later the Botanical Garden of Ivan Franko National University of Lviv (1852), Chernivtsi National University (1877) and Botanical Garden of Odesa National University (1880) were created.

These Botanical gardens function today and maintain the unique specimens (plants age within the range of 80–125 years) in both outdoor and indoor collections. In the 20th century a lot of new botanical gardens in Ukraine have been established. At present in Ukraine, the existence of 33 botanical gardens has been formalized. These gardens belong to different agencies: National Academy of Sciences, Ministry of Education and Science, Ministry of Ecology and Natural Resources, National Academy of Agrarian Sciences. Additionally, some of the botanical gardens have the local or regional status.

At the botanical gardens of universities linked with the education, the accumulated collections contain predominantly plants suitable for presentation of various forms of plant diversity (e.g. organ metamorphoses, ecological adaptations,distinct modes of vegetative propagation and seed dispersal), while the botanical gardens of National Academy of Sciences are mainly focused on collections appropriate for scientific researches or on *ex situ* conservation issues. In particular, M.M. Gryshko National Botanical Garden (NBG), NAS of Ukraine (founded in 1935), is one of the top botanical research institutions and Botanical Gardens in Ukraine.

Living collections of plants in Botanical Garden of Ukraine vary in number from a few hundred to several thousand different species, depending on institutional affiliation and an institution's objectives as well as the financial and scholarly resources.

At present time the most numerous living plant collections of tropical plants have been accumulated at O.V. Fomin Botanical Garden, Taras Shevchenko National University of Kyiv, Botanical Garden of Ivan Franko Lviv National University and M.M. Gryshko National Botanical Garden. All of them have the status of National Heritage Collections of Ukraine and are supported through State funding.

Today, the main task of each botanical garden of Ukraine is to preserve existing collections and replenish them, but the issue of preserving human resources and the appropriate level of funding for institutions to cover the high costs of collection maintenance, remains extremely important.

If the priority tasks are solved, it will be possible to expand the existing development

trends, which can be implemented in various ways, e.g., by participating in international research projects, development of educational programs and attracting tourists seeking to enter the botanical gardens as centers, representing cultural and historical heritage.

Key words: Ukraine, Botanical gardens, history, uniqueness, National Heritage Collections, purpose

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THE ENJOYMENT OF GREEN SPACES. TOWARDS A NEW MINDSET IN THE MANAGEMENT OF HISTORICAL GARDENS

BLANCA LASSO DE LA VEGA WESTENDORP
La Concepción Botanical and Historical Garden. Camino, Málaga, Spain.

Historical gardens are places to observe and feel. They are mostly places for strolling and contemplating, attracting people who are interested in plants, beauty, and the mark of past times. However, nowadays, green spaces promote a different approach to the experience of the simple walk, offering diverse activities for all ages, from modern technologies that allow you to find out about a plant or the history of the garden at the swipe of a mobile, all the way to "feeling" the park through photography, painting, sport, meditation, exhibitions, and specific workshops that transmit knowledge of Botany, Horticulture, Gardening, History, Floral Art, Design, etc. Through all these activities, we can direct the visitor's gaze towards the respect and conservation of these unique enclaves, highlighting their value and dignifying their botanical and historical heritage, giving purpose to its existence and increasing the benefits that it can give to the city and the region that hosts it.

The *La Concepción* Historical Botanical Garden was created in 1855 by an affluent family from Malaga's bourgeoisie, who bought an agricultural estate in production in which they developed a garden with the help of a French horticulturist. In 1943 it was declared a historical-artistic garden (now a Site of Cultural Interest) and in 1990, Malaga's City Council acquired it to turn it into a historical botanical garden for all audiences. It was inaugurated in July 1994 and, since then, the aim has been to attract visitors through various activities, initially for schoolchildren, later for young people, and now for all audiences.

The experience accumulated over these years is presented in this congress in the hope that it will serve for the management of other parks and gardens.

Keywords: Historical gardens, Conservation, Management, La Concepción.

MUSEU NACIONAL DE HISTÓRIA NATURAL E DA CIÊNCIA, LISBOA | OCTOBER 11TH-12TH 2021
1st International Congress of Historical Botanic Gardens
Promoting and Protecting our Historical Legacy

LINKING HISTORICAL PAST WITH THE CONTEMPORARY CHALLENGES IN THE UNIVERSITY OF WARSAW BOTANIC GARDEN

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University of Warsaw Botanic Garden, Warszawa, POLAND

Abstract:

The University of Warsaw Botanic Garden is one of the oldest botanic gardens in Poland. It was founded in 1818 and has a remarkable history**.** In 1831 the Royal University of Warsaw was closed by the tsar and the Garden's area was severely reduced. In 1916 the Garden became a part of the re-established University of Warsaw, new sections were then created (plant biology, ornamental plants and a rose garden), renovation of greenhouses started, and collections of woody plants were extended. The greatly developing institution was destroyed during the 2nd World War. Just after the war Garden's buildings and greenhouses were rebuilt and the works on reconstructing collections began. At the end of the 20th century the section of plant biology regained its historical form, the collection of roses, climbers, medicinal and useful plants were modernised and enriched, and the original greenhouses have been renovated and extended.

Nowadays University of Warsaw Botanic Garden occupies an area of 5.16 ha. It includes nine sections (plant collections) and three greenhouses with tropical, subtropical and succulent plants. Live collections of *ca* 5,500 taxons are supplemented by a *Herbarium* and a digital collection of botanic illustrations (*Floratheca*). The Garden is located in the city centre at the Royal Route, surrounded by the historical parks. As a monument recorded on a list of heritage registers of Warsaw, the Garden is covered by the control of the provincial monument conservator. All reconstruction and modernization works requires conservator's acceptance, including the conservation of the old trees, among which there are 23 natural monuments. It is quite a challenge to adjust the monumental park and buildings to contemporary needs, linking the preservation of historic matter with the creation of modern collections, attractive and accessible for all users.

The paper presents how the University of Warsaw Botanic Garden meets the challenges of a modern scientific, educational and recreational centre, equally preserving its historical form.

Keywords: collection, greenhouse, monument

MUSEU NACIONAL DE HISTÓRIA NATURAL E DA CIÊNCIA, LISBOA | OCTOBER 11TH-12TH 2021
1st International Congress of Historical Botanic Gardens
Promoting and Protecting our Historical Legacy

THE MANAGEMENT OF A HISTORICAL BOTANICAL GARDEN IN POLAND – REQUIREMENTS AND CHALLENGES.

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The functioning of botanical gardens in Poland is primarily determined by the Nature Conservation Law, a general normative act specifying the goals, principles and forms of nature and landscape protection. It defines administrative procedures related to activities carried out in green areas,including botanical gardens. At the same time, historical botanical gardens are subject to the rules resulting from the Law on the Protection of Monuments, which defines the procedures and activities of administrative bodies to ensure, among others, the continuity of historic garden arrangements. Thepresentation highlights the challenges related to the operation of a historical botanical garden, basedon the example of the Botanical Garden of the Adam Mickiewicz University in Poznań.

The Botanical Garden in Poznań was officially opened in 1925 with an initial area

of 2.5 ha. Established as a didactic institution, the garden was mainly comprised of the Plant Systematic Section, developedaccording to the taxonomic system created by Adolf Engler. The most important architectural object built at that time was the wooden Summer Hall, where classes took place. During first 50 years of theGarden's existence, new areas were added, amounting to nearly 16 ha. The collections have been composed partly in a regular French style, partly in a landscape style, with characteristic alley layouts.Till today, both the Summer Hall and the original outline of walking paths are preserved. In the year 2000, the last 6 ha were added, completing thereby the premises of our institution (ca. 22 ha). No further enlargement is possible due to the urbanized area the Garden is surrounded by.

In 1975, the garden as a whole composition was included in the Register of Monuments, which is a listof historical objects under special legal protection in Poland. The particular items under conservation protection are: the Summer Hall with the benches in front of it, the main gate and garden sculptures. Today, the Garden has therefore a part protected only by the Nature Conservation Law (6 ha) and another covered additionally by the Law on Protection of Monuments (16 ha).

The protection in form of specific legal regulations is extremely important from the point of view of the preservation of historic monuments. At the same time, the specificity of the functioning of botanical gardens causes that some of the formal and legal requirements resulting from the Nature Conservation Law do not apply to them, e.g. it is not required to obtain an administrative decision to fell a tree.

However, such simplifications of procedures do not apply to the historical gardens, where all activitieshave to be consulted with the Conservation Office. Removal of dying or withering trees and shrubs as well as renovation of infrastructure, like roads or buildings are tasks that require appropriate administrative decisions to be obtained in advance.

This issue was discussed several times with national authorities, but so far no changes facilitating functioning of the historic botanical gardens in Poland have been introduced. Therefore, these institutions need to comply with two different legal acts.

• **Keywords**: historic botanical garden

TRIED, TESTED - OPPORTUNITIES FOR PRIVATE BOTANICAL GARDENS IN THE TOURIST INDUSTRY

RÉKA FOLLY

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This story begins hundred and sixteen 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 Lake Balaton. The garden is still privately owned by the Folly family. Our philosophy revolves around the notion that the garden – above and beyond being just a collection if rare or valuable plants - must be provided as a beautiful backdrop to activities of everyday life

Keywords: Arboretum, Winery, Pines, tourism, visitors

1st ICHBG
BOTANICAL GARDENS WITH HISTORY

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1st International Congress of Historical Botanic Gardens

Promoting and Protecting our Historical Legacy

CONCLUSÕES

CONCLUSIONS

1st International Congress of Historic Botanical Gardens

Summary of sessions and conference conclusions

Opening ceremony
There were welcome addresses by representatives of the organizations involved in the preparation of the conferences emphazising the importance of the conference subject and topics. The conference was then declared open by the Vicepresident of the International Association of Botanical Gardens (IABG), Michael Kiehn.

Keynote lecture by Tim Entwistle, President of the IABG
Tim presented the structure and the work of the IABG – with special emphasis on the relevance for Historic Botanical Gardens. He also showed examples of how botanic gardens can deal with their historical background to use it for actual and future projects.

Theme 1: Historic Botanic Gardens (Case studies and definitions)
In its keynote lecture, Peter Wyse Jackson highlighted the remarkable number of Botanic gardens created over the last 40 years as well as the many national and international organizations (e.g., Botanic Gardens Conservation International) or policies (as the Global Strategy for Plant Conservation or the U.N. Sustainable Development goals) established at the same time. Through research, conservation and education actions BGs have considerably influenced sustainable development in relation to biodiversity and climate change responses, even (partly through new media channels) during the pandemy.
The next speakers presented, from the perspective of "old" Botanical Gardens, overviews about historical developments, changes of interests and missions over the centuries, current functions of historical BGs collections, co-operations, conservation and ex situ management of threatened species, including special foci on old trees, education and training, also paying attention to the social role incl. public engagement, or to the inspiration for artists.
Different approaches for defining Historical Botanical Gardens were discussed (see below – round table).
The session finishes with a call for more botanic gardens to address the great global challenges to be faced in the future, by learning from our past and developing priorities that align with the greatest needs to safeguard plants and nature for the

Theme 2: Botanic Gardens and the introduction of economically important species
The keynote of Esteban Bermejo showed the multifaced ways of exchange of economically important plants between different parts of the world and the role Botanical Gardens played in this process.
He emphazied that we still lack awareness about many of these processes and actors, especially for minor or underutilized crops, and that this is an important topic of the history of many Botanic Gardens.

Theme 3: History is now – documenting and protecting contemporary gardens for posteriority
In the keynote lecture Michael Kiehn stated that is the true nature of botanic gardens to evolve, and permanently facing changes regarding their missions, their statute, their collections as well as their buildings or their design. This raises questions which historic components to safeguard. Many ways of documentation (plant lists, databases, documents, testimonies of every change) are useful for optimal and synergetic decisions what is worth protecting.
The following speakers pointed to the need of skilled gardeners to secure the survival of collections heritage value, requiring proper training and options to pass on experience to the next person in charge, and to share information collected in an individual garden with other gardens and larger professional networks.

Theme 4: Managing Historic Botanical Gardens (problems and issues) preserving the past while responding to contemporary needs.

In her keynote lecture Teresa Andresen presented the program of touristic routes of Historical Gardens in Portugal (which includes the BGs of the University of Lisbon, Coimbra, Porto, and Madeira) and is part of the European Routes of Historic Gardens. She explained the selection and certification process and the benefits for the participating gardens.
After a short discussion about certification schemes and criteria also the importance of having skillful gardeners/owners was emphasized, which is increased by the network developed in the process.
The following presenters showed examples for different types of restoration projects related to historic buildings or thematic displays, including interesting ways how to finance such activities. But also problems encountered in historical gardens (depletion of soils, invasive species, climate change effects) were addressed. Best practices to promote old trees or conservation of threatened species were shown.

Theme 5: Tourism opportunities for Historical Botanic Gardens

The speakers clearly pointed out the synergies between Historic Botanical Gardens and tourism. Different approaches based on SWAT-analyses show the advantages for public and society (unique settings, unique enigmatic plants, historical backgrounds) and for the the garden managers/owners (income, recognition, involvement in regional/sectoral projects). Also the importance of developing different ways of telling the stories of places and collections was emphasised.

Poster presentations:

Ten poster presentations included reports about the history of gardens in Athens (Greece), Posnan and Warsaw (Poland), Ucraine, Lisbon (Portugal) and Hungary. They dealt with a number of topics of broad interest, e.g.:

- Problems caused by progressive urbanization, like constant lowering of groundwater levels, increasing noise pollution, lack of possibilities to further expand the garden area, but also to some positive effects like well-developed public transport network.
- Conservation of indigenous genetic material, selection of genotypes with special characters (e.g., taste) and cultivation characteristics as well as resistance to various stresses. This can serve as springboard for the commercialization and sustainable utilization in future breeding programs of wild-growing fruit species.
- Challenges connected with management of special collections (like succulents) requiring constant substantive supervision and high commitment of employees.
- Keeping updated regarding taxonomic changes (in databases and labelling).
- Development of gardens devoted to special topics (e.g., to Arts, to explore, research, and disseminate the connections between Art and Science by promoting knowledge of plants from around the world that are used to provide raw materials for artistic practice throughout history).
- The importance of national networks to secure the work of Botanical Gardens (shown for Ucraine, with the goal to develop Botanical Gardens as places representing both cultural and historical heritage).
- Difficulties arising from a legal status as historical monument, e.g., for a public oriented management of trees and sites.
- Synergies of Historic Botanical Gardens with tourism.

Round table: Promoting and protecting our historical legacy

After intensive discussion on a need of a definition for "Historic Botanical Garden", and of elements and aspects to be considered (e.g., that a definition must result in an added value for the gardens covered by that definition, and that it is necessary to encourage synergies between preservation, development, and public needs and demands) a definition was proposed:

Historic Botanical Garden: A botanic garden accessible to and useful for the public, being a testimonial for the history of Sciences, with recognized and documented historical value that has preserved authenticity and integrity.

It was agreed that a qualification scheme for Historic Botanical Gardens will be needed.

The International Association of Botanical Garden (IABG) committed itself to develop a scheme for the recognition/accreditaion of Historic Botanical Gardens and will work on tis using the results of the discussions of the conference.

Two personal additions:

- **Many thanks again to Dalila, George and the whole organizing team**
- **Many people have expressed an interest in a follow-up congress – and we even have received already first bids for potential organisers – thus we should seriously plan this – perhaps in three years time**

Summary compiled by Michael Kiehn; with support of Maité Delmas, Eleni Maloupa, and Teresa Andresen

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