GROWING AN INTERNATIONAL MOVEMENT FOR PLANT CONSERVATION AND PLANT RESOURCE MANAGEMENT: THE DEVELOPMENT OF THE INTERNATIONAL BOTANIC GARDEN COMMUNITY

Menumbuhkan gerakan internasional bagi upaya konservasi dan pengelolaan sumber daya tumbuhan: pembangunan komunitas kebun raya internasional

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Abstrak

Dua puluh hingga tiga puluh tahun terakhir ini dapat dikatakan merupakan masa kebangkitan baru kebun raya di seluruh dunia. Salah satu penyebab utamanya adalah semakin meningkatnya kepedulian masyarakat dunia terkait dengan isu hilangnya keanekaragaman hayati. Selain itu juga karena kebutuhan yang lebih besar akan institusi-institusi yang berkiprah secara aktif di bidang konservasi sumber daya tumbuhan. Komunitas kebun raya dunia mengalami perkembangan pesat, tidak saja dari sisi jumlah kebun raya baru yang terbangun tetapi juga dari sisi tujuan dan fungsinya. Saat ini tercatat tidak kurang dari 2.500 kebun raya di seluruh dunia. Untuk mempersiapkan sebuah kerangka kerja global bagi kebijakan-kebijakan, program dan prioritas kebun raya dunia di bidang konservasi keanekaragaman hayati, pada tahun 2000 BGCI telah mempublikasi Internasional Agenda for Botanic Gardens in Conservation, di mana tercantum misi global kebun raya dunia.

Kata kunci: Kebun raya, masa kebangkitan baru, agenda internasional, konservasi hayati.

INTRODUCTION

The international botanic gardens community has undergone a remarkable transformation over the last few decades. Not only have hundreds of new botanic gardens been created worldwide over the last years, but also their rationale, objectives and functions have fundamentally changed to address new priorities and the changing realities for scientific institutions worldwide. As the greatest repositories of living plant collections worldwide, their importance and roles are so much better understood and appreciated by increasingly wide audiences and many botanic garden have been reinvigorated and rejuvenated to undertake a wide range of new tasks, particularly in education and plant conservation.

Worldwide botanic gardens receive more than 250 million visitors per annum. As well as that, the contribution of botanic gardens to cultural development, to economic progress and commercial expansion has been of very great significance to many countries throughout the world over the last four centuries since the first botanic garden was created and at the present time these contributions are every bit as important as they ever were.

I have often been asked "how many botanic gardens are there in the world?", a question which is difficult to answer satisfactorily – partly because it is not always easy to define whether a particular garden is "botanic" or not, but mainly because, remarkably, there are so many new botanic gardens being created throughout the world that whenever I give a figure it is almost immediately out of date. Almost weekly I hear of a new botanic garden being planned or established somewhere in the world. Today we know of over 2,500 institutions defined as botanic gardens, in about 155 countries.

BOTANIC GARDEN HISTORY AND ORIGINS

In Europe, the first botanic gardens to be founded were medicinal or physic gardens whose primary function was to provide material and facilities for students in university faculties of medicine in Italy, France, Switzerland, the Netherlands, Ireland, the U.K. and other countries. Over time many of these gardens adopted wider roles in scientific research, particularly in plant classification and taxonomic botany, roles that continue up to the present day. In other parts of the world earlier gardens which could claim to be "botanic" were created in previous civilizations, such as China, Greece, pre-Hispanic Mexico and the Arab world, but we still have too little knowledge of how they functioned to be sure whether any can really be described as the first true botanic gardens.

What is generally regarded as the first ever botanic garden was the medicinal garden established at Pisa in 1543. It was followed closely by Padua (1545) (which still survives today in its original form), Florence (1545) and Bologna (1547). Then came Zurich (1560), Leiden (1577), Leipzig (1579), Paris (1597), Montpellier (1598), Oxford (1621), Uppsala (1655), Edinburgh (1670), Berlin (1679), Amsterdam (1682) and Dublin (1687). All of these botanic gardens exist to today, most of them in their original locations. From these early beginnings many of the major European botanic gardens have evolved to become the great institutions they are today, representing "classic" botanic gardens with a broad range of activities in horticulture, horticultural training, research (particularly in taxonomy and increasingly in conservation biology – with associated herbaria and laboratories), public amenity and education. This botanic garden model has been widely adopted in other countries mainly as national institutions.

The development of early tropical botanic gardens was more motivated by considerations of trade and commerce than by science for its own sake. European colonial powers, particularly Britain, the Netherlands, and to a lesser extent Germany, Belgium, Spain and Portugal, established important tropical botanic gardens in their colonies in Africa, the Caribbean, India, South-East Asia and South America in the 18th and 19th centuries. The first botanic garden to be founded in the tropics was the Pamplemousses Garden in the Indian Ocean island of Mauritius, founded in 1729 (now the Sir Seewoosagur Ramgoolam Botanic Garden). It was initially established to provide fresh fruit and vegetables for the colony and to provide provisions for ships calling at the nearly port of St Louis. Through the Garden many economic plants were introduced, such as sugarcane and spice plants, which became the basis of the island's economy. Many of the earliest tropical botanic gardens had similar origins through which economically useful plants were introduced, such as breadfruit, cinchona, cloves, cocoa, coffee, oil palm and rubber, often associated with one of the major European gardens such as Amsterdam and Kew.

Of course Kebun Raya Bogor is a wonderful example of a garden that arose as a result of such colonial and economic developments and expansions having been founded in 1817, which is today taking

on so many new roles and importance as a centre for research, conservation, horticulture and environmental education in Indonesia and for the Indonesian nation, bringing knowledge and appreciation of plants to the millions of visitors who have enjoyed the Gardens over the last few decades.

There are many other examples of notable early tropical gardens, many of which still thrive today, such as the following: St Vincent (1765); St Denis, Réunion Island (1765); Calcutta (Kolkatta), India (1787); Rio de Janeiro, Brazil (1808); Sydney (1816) and Hobart (1818), Australia; Peradeniya, Sri Lanka (1821); Durban, South Africa (1849); Singapore (1859), Bath (1779), Castleton (1859), Cinchona (1868) and Kingston (1872), Jamaica.

In temperate regions, a large number of urban 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. Many of these gardens did not develop major scientific facilities but there are notable exceptions to this, such as Missouri Botanical Garden, which was founded in 1859, the first botanic garden in the United States. Another exception was the Palmengarten in Frankfurt, Germany, founded in 1869. Most of these municipal botanic gardens developed significant activities in horticulture, building and maintaining major documented plant collections.

In the countries of the former Soviet Union, the earliest botanic gardens are in Russia – the Apothecaries Garden of Moscow State University was created in 1706 and the Botanic Gardens of the Komarov Institute in St Petersburg, was founded in 1713 - but many of 100 botanic gardens have been created within the last fifty years, mainly to act as centres for botanical research and plant introduction and generally associated with their national academies of science and universities. In China, more than 150 botanic gardens have been created in the last twenty years, mainly to support horticulture, research, native plant conservation, local education and as a place for public relaxation.

A RENAISSANCE IN BOTANIC GARDENS

In the last twenty to thirty years, there has been a renaissance in botanic gardens worldwide, largely as a result of the developing concern for biodiversity loss and the need for many more institutions to become active in plant resources conservation. There has also been a corresponding rise in botanic garden involvement in research and conservation of the floras of the regions or countries in which they are situated. In some countries, most notably in Australia, Brazil, Colombia, India, Mexico and others, a recent trend has been the creation of local or community botanic gardens. These are often relatively modest institutions developed and managed by community groups to suit a variety of local needs, for plant conservation (such as of medicinal plants in several developing countries), environmental education and public amenity. The collections of these gardens are predominantly made up of native species and often constituted to support or complement nearby efforts made to conserve plants in their natural habitats, in nature reserves and national parks.

In 2001, it was estimated that there are 2,178 botanic gardens known in the world, in 153 countries (Wyse Jackson, 2001; Wyse Jackson and Leadlay, 2001). At that time there were about 55 countries and territories not known to have even a single botanic garden. However since that time there are now botanic gardens and or new botanic garden projects known, underway or proposed in nine countries where there were formerly none (Burkina Faso, Chad, Cyprus, Haiti, Jordan, Lao, Palau, Qatar and Tonga).

Since then the number of known botanic gardens has grown even further to include over 2,500 (documented in the on-line 'Garden Search' database maintained by Botanic Gardens Conservation International (www.bgci.org). While it is clear that not all of the institutions listed as botanic gardens function as well-resourced or active botanical or scientific institutions, nevertheless it is clear that there is a greater number of active botanical institutions in the world than ever before. Reviewing

the dates of the establishment of the world's botanic gardens it is also notable that more than 50% of the botanic gardens have been established since 1950 and that well in excess of 200 new botanic gardens have been created since 1990.

DEFINING THE BOTANIC GARDEN

But how do we define what is a botanic garden? What makes a botanic garden different from any public park, recreation area or indeed from our own private gardens? It is not an easy question to answer and until recently there has not been a widely accepted definition of a botanic garden available. In the 1960s, a definition of a botanic garden given by the International Association of Botanic Gardens (IABG) was '...a botanic garden or arboretum is one open to the public and in which the plants are labelled' – which is fine as far as it goes. But what about their roles as centres for education, amenity and recreation, biodiversity conservation, scientific research, horticulture, training, tourism, information management and other activities? It is actually the complex interactions and applications of this diversity of roles and activities that makes botanic gardens unique.

There are no formal criteria or general agreement as to what constitute a botanic garden. Therefore any list of botanic gardens is somewhat subjective and can neither be fully comprehensive nor regarded as definitive. The most recent definition of a botanic garden is that provided in the *International Agenda for Botanic Gardens in Conservation* (Wyse Jackson and Sutherland, 2000). This definition perhaps encompasses and reflects the diversity of institutions that the spirit of a true botanic garden: *'Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education'* (Wyse Jackson, 1999).

The lack of a very clear definition as to what constitutes a 'botanic garden' has blurred the edges between what are public parks or private collections and what are true scientifically-based botanic gardens. Some institutions have been accepted into the list even though they might only be marginally described as a botanic garden. *The Botanic Gardens Conservation Strategy* (IUCN-BGCS and WWF 1989) contains a more comprehensive list of characteristics (below) defining a botanic garden that incorporate the diversity of roles that these institutions now undertake.

Defining characteristics of a botanic garden

- adequate labeling of the plants
- an underlying scientific basis for the collections
- communication of information to other gardens, institutions, organisations and the public
- exchange of seeds or other materials with other botanic gardens, arboreta or research stations (within the guidelines of international conventions and national laws and customs regulations)
- long term commitment to, and responsibility for, the maintenance of plant collections
- maintenance of research programmes in plant taxonomy in associated herbaria
- monitoring of the plants in the collection
- open to the public
- promoting conservation through extension and environmental education activities
- proper documentation of the collections, including wild origin
- undertaking scientific or technical research on plants in the collections

This list does not, however, constitute a comprehensive summary of the activities undertaken by botanic gardens (Adapted from IUCN-BGCS and WWF, 1989)

It should be recognised that there are many institutions that are clearly botanic gardens but are only able to meet some of these criteria. Furthermore, in some instances a garden has retained the name 'botanic' for historic reasons. Some or even most of the plant collection may survive but all scientific activities have ceased and documentation has been lost. One might argue for the removal of these from the global list of botanic gardens. However, experience has shown that it is

precisely these institutions in many parts of the world that are currently being revived, redeveloped and re-established to become potentially important botanical centres.

THE EXPANSION OF BOTANIC GARDEN NUMBERS WORLDWIDE

It is useful and interesting to review the reasons for this great expansion in botanic gardens and their resources worldwide. Traditionally the majority of botanic gardens have been situated in temperate countries of Europe, North America and Australasia. While there are still very large numbers of botanic gardens in such countries, where new ones are also being created, there has also been very considerable development of botanic gardens in many tropical countries too.

The development of botanic gardens in Brazil illustrates well the remarkable recent growth of botanic gardens in that country (Table 1). Like Indonesia, Brazil is rich in plant species. Current estimates suggest that Brazil may contain in the region of 55,000 plant species, making the development of a strong base of botanic gardens an urgent priority, to help manage and conserve such a rich heritage and diversity of plants.

The Rio de Janeiro Botanic Gardens, founded in 1808, remains the largest, oldest and best supported botanical institution in that country. Indeed it was the first botanic garden created in South America and is today the leading botanical institution in the continent. The second botanic garden founded in Brazil later that century was the Museu Paraense Emílio Goeldi e Parque Zoobotânico in Belem, in the State of Pará. The other major botanic garden established in 1938 was the Jardim Botânico de São Paulo. However, in the latter part of the 20th century a remarkable explosion in the number of botanic gardens there took place. In the *International Directory of Botanical Gardens II* (1969) four botanic gardens are listed. In a subsequent International Directory published in 1990 (Heywood *et al.*, 1990), the number of botanic gardens in Brazil had grown to eleven. In 2000, in a Directory of Brazilian Botanical Gardens (Bruni *et al.*, 2000) the number had grown to include 26 institutions (three of those listed in 1990 are no longer mentioned). In a review of the world's botanic gardens prepared in 2001 (Wyse Jackson, 2001) the number listed had grown to 29 and in 2009 the BGCI on-line 'Garden Search' database of botanic gardens of the world lists 40 institutions.

Table 1. The progress in the establishment of botanic gardens in Brazil

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PLANT CONSERVATION NEEDS – A DRIVER FOR BOTANIC GARDEN DEVELOPMENT

Worldwide it is recognised that tens of thousands of plant species are rare or endangered and potentially face extinction this century if current trends continue. Although the potential extinction crisis faced by plants worldwide has been acknowledged for several decades, only recently has a coherent plan of action for their conservation been proposed and agreed to address the potential loss of so much of the world's plant diversity. Although it is recognised that the conservation of plant resources plants is fundamental to the future survival of humanity and of many other species that reply on plants to provide the fabric of most terrestrial ecosystems, nevertheless, plant conservation has barely received the attention that it needs until recent years.

Nevertheless it is clear that the expansion in the number and functions of botanic gardens worldwide has been driven by the environmental crisis where botanic gardens have understood that they have a substantial role to play in safeguarding plant resources and providing leadership not only in plant conservation but also in promoting the importance of plants for global sustainability.

INTERNATIONAL AGENDA FOR BOTANIC GARDEN CONSERVATION

To assist botanic gardens worldwide set their own future agendas that coincide with the changes that are impacting on the world and to help guide our future responses to the environmental crisis, in 2000 Botanic Gardens Conservation International (BGCI) prepared and published the *International Agenda for Botanic Garden in Conservation* to provide a global framework for botanic garden policies, programmes and priorities in biodiversity conservation (Wyse Jackson and Sutherland, 2000). It was based on contributions from and consultations with over 300 institutions and individuals throughout the international botanic garden, botanical and conservation communities.

The International Agenda defines the global mission of botanic gardens worldwide in conservation as follows:

- Stem the loss of plant species and their genetic diversity worldwide.
- Focus on preventing further degradation of the world's natural environment.
- Raise public understanding of the value of plant diversity and the threats it faces.
- Implement practical action for the benefit and improvement of the world's natural environment.
- Promote and ensure the sustainable use of the world's natural resources for present and future generations.

As proposed in the International Agenda, a registration system for botanic gardens was launched some years ago to which about 500 botanic gardens worldwide have registered their contributions to the achievement of the International Agenda by making a written undertaking to work for the implementation of its provisions. It invites botanic gardens to adopt the International Agenda as their (or part of their) institutional policy on conservation.

The *International Agenda for Botanic Gardens* has also been formally recognised by the international community too, and specifically by the United Nations Convention on Biological Diversity, which noted that it represents an important component of and contribution to the achievement of the CBD's *Global Strategy for Plant Conservation*.

For botanic gardens, the adoption of the Global Strategy for Plant Conservation in 2002 was both a significant landmark as well as a major achievement. Botanic gardens were central to the development and subsequently to the implementation of this strategy (Wyse Jackson, 2002). It clearly demonstrated the value of botanic gardens immersing themselves in the political world of biodiversity policy making and advocacy.

THE GLOBAL STRATEGY FOR PLANT CONSERVATION

The adoption by the Convention on Biological Diversity of *the Global Strategy for Plant Conservation* (GSPC) in April 2002, therefore presented significant new opportunities and challenges for the botanical community throughout the world. The Strategy was developed in response to a growing realisation that up to 100,000 plant species are currently threatened worldwide and urgent new concerted action to promote new programmes focused on plants is urgently needed if huge losses in plant diversity are to be averted.

Scope of the Global Strategy for Plant Conservation:

- Understanding and documenting plant diversity
- Conserving plant diversity
- Using plant diversity sustainably
- Promoting education & awareness about plant diversity
- Capacity building for plant diversity

The ultimate and long-term objective of *the Global Strategy for Plant Conservation* is to halt the current and continuing loss of plant diversity. The Strategy will provide a framework to facilitate harmony between existing initiatives aimed at plant conservation, to identify gaps where new initiatives are required, and to promote mobilization of the necessary resources. It will also provide a tool to enhance ecosystem conservation and the sustainable use of biodiversity and to focus on the vital role of plants in the structure and functioning of ecological systems and assure the continued and future provision of the goods and services such systems provide.

The Strategy includes a series of 16 outcome-orientated targets that propose what needs to be achieved for plant conservation by 2010. The GSPC also provides a new and innovative framework against which government programmes and the initiatives undertaken by a wide range of national and international organisations could be aligned. Through the adoption of the GSPC governments throughout the world have committed themselves to the implementation of the GSPC and to the achievement of the 16 international targets. In 2009, a comprehensive report on its achievements and progress made was published (CBD Secretariat and GPPC, 2009). Although the first phase of the GSPC (2002-2010) has almost come to an end, negotiations are underway towards a second phase, probably from 2010 to 2020, when revised targets and renewed objectives will be adopted to help move forward the international plant conservation agenda with continued urgency. The new Strategy is also likely to adopt measures that take into consideration issues including climate change and the need to align plant conservation policies more effectively with each country's development agenda, helping to ensure that economics, sustainable development and biodiversity can go hand in hand.

CONCLUSION

Clearly the new *Global Strategy for Plant Conservation* lays down a challenge and task for us in botanic gardens over the coming years. I have no doubt that botanic gardens will be amongst the leaders in helping to achieve many of its targets. The 21st century will be an exciting and important time for all botanic gardens worldwide when they will face increasingly challenging tasks. We now recognise that there is a desperately urgent extinction crisis facing the world's biodiversity. Over the coming century it is estimated that up to two-thirds of the world's plants will become threatened in the wild – the threat from climate change makes an already serious situation potentially much worse (Hawkins *et al.*, 2008). Botanic gardens are responding with the development of new plant conservation initiatives throughout the world as well as embracing the need to raise public concern for plants and the environment. For all of us working in botanic gardens, it is very rewarding to be part of a movement that is increasingly recognized worldwide for its importance and for the roles that we must play in safeguarding plant diversity for present and future generations.

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