Review

Botanic Gardens in Biodiversity Conservation and Sustainability: History, Contemporary Engagements, Challenges and Renewed Potential

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Botanic Gardens in Biodiversity Conservation and Sustainability: History, Contemporary Engagements, Challenges and Renewed Potential

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Abstract: A burgeoning body of scholarship identifies and discusses botanic gardens as increasingly important centres of biodiversity conservation and sustainability. Notwithstanding the high quality and richness of this literature, it encompasses relatively autonomous fields of expertise that are neither designed nor expected to promote cross-disciplinary, integrative, accounts of botanic gardens as institutions of conservation and sustainability. Bridging key aspects of the botanic garden literature, this article brings into conversation historical accounts with contemporary scholarship on the matter. In so doing, it unveils dilemmas and challenges faced by botanic gardens as they grapple with their historic legacies, but also renew their relevance in nurturing sustainable socio-environmental futures. The article proceeds by covering three focal points. First, it summarizes the scholarly literature on the history of botanic gardens. Second, it presents accounts of current scientific and biodiversity conservation endeavours as reflexive engagements with their historical legacies. Third, it addresses the recent emergence of socio-cultural missions at botanic gardens as a significant step beyond their historical focus on plants and plant ecosystems.

Keywords: botanic garden; history; sustainability; biodiversity; conservation; decolonization; science communication; education; SDG; socio-cultural

1. Introduction

Cutting edge theories of botanic gardens demonstrate that these institutions have played instrumental governance roles throughout the course of their existence[1]. They have facilitated the emergence and consolidation of the modern nation state, supported European colonialism and empire-building processes [2] and, more recently, spearheaded the governance of plant biodiversity on a global scale. As such, they are far from the quaint self-directed institutions that general audiences may perceive them to be. Aligned with their rich history, the legacy of botanic garden involvement with governance poses both challenges and exciting opportunities for their continued relevance *vis-à-vis* contemporary biodiversity conservation demands. The main contribution of the present review is to situate the extant scholarly literature on botanic gardens in relation to the fruitful momentum that this reflexivity affords.

The modern botanical garden institution [3,4] came into existence a little over 400 years ago with the establishment of the first gardens dedicated to the systematic study of medicinal plants. Having evolved out of earlier monastic gardens, modern botanic gardens appeared at the intersection of the rise of modern science and European encounters with plant worlds previously unknown in Europe. Botanic gardens played instrumental roles in classifying these plants as well as in determining possible economical advantages associated with their commercialization. They were also instrumental in developing techniques to acclimatize plants across distinct geographic regions which, in turn, allowed many European countries to draw enormous gain from establishing new crop-based economies on a global scale [5,6]. In time, botanic gardens came to play instrumental roles in the processes of colonial expansion and empire building that are associated with the consolidation of modern nation states in Europe. At the height of their entanglement with these dynamics, botanic

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gardens were connected with one another on a truly global scale. These connections amounted to a complex network of collaborations, material exchanges, and knowledge flows that remain one of the greatest assets of the botanical garden institution to this day.

Throughout the latter part of the 20th century botanic gardens reinvented themselves as institutions of biodiversity conservation. With the onset of growing recognition of global biodiversity loss that is associated with the environmental movements in the 1960s and 1970s, an expanding number of botanic gardens began to transform themselves as institutions of plant biodiversity conservation. In many places, and most notably in the global south, new botanic gardens were inaugurated to tackle this issue. The establishment of Botanical Gardens Conservation International (BGCI) and its leadership in the development and implementation of a Global Strategy for Plant Conservation, further solidified the status of botanic gardens as instrumental agents in the mitigation of plant biodiversity loss. In the process of these changes, many botanic gardens have also embraced social missions that recognize the inextricable dynamics that connect human and plant worlds, on which rests the sustainability of earth's ecosystems [7,8].

As botanic gardens re-invent themselves as institutions of global sustainability, grounded in principles of social equity [9] and environmental justice, they are often confronted with the legacies of former colonial arrangements [10,11]. This matter has become increasingly important in recent years, with leading botanic gardens now embracing highly productive conversations on what decolonizing their institutions may entail. Arguably, taking steps to understand the conundrums that this may pose is highly pertinent. This review is another step in that direction [12]. To these ends, the article proceeds by covering three focal points. First, it summarizes the scholarly literature on the history of botanic gardens. Second, it presents accounts of current scientific and biodiversity conservation endeavours at botanic gardens vis-à-vis former colonial histories. Third, it addresses the recent emergence of socio-cultural missions at botanic gardens as significant step beyond their historical focus on plants and plant ecosystems.

2. Historical Evolution of the Botanic Garden [13]

It is standard practice in the scholarly literature to present the history of botanic gardens in sequential fashion, dividing it into major periods that are each characterized by specific central mandates at botanic gardens. There is some variation in how these periods are divided, depending on author focus and/or the source's main purpose **[**14**]**. For the sake of brevity, the present overview condenses the historical evolution of botanic gardens into two main stages. The first covers the foundation and consolidation of the botanical garden institution, and a period of embroilment with colonialism and empire building. The second focuses on their relatively recent shift toward biodiversity conservation. Later sections of this review complicate the linearity of accounts of botanic garden history by pointing to reflexive engagement with historic legacy in the context of biodiversity conservation.

The modern botanic garden institution came into existence in late 16th century Europe. Botanic gardens owe their origins to monastic and physic gardens. These were sites where plants were grown for practical purposes related to nourishment and health, but also as means to reflect on biblical discussions of God's will as manifested through creation[15]. These questions acquired renewed pertinence with the arrival of Europeans in the American continent and their encounters with ecosystems and plants previously unknown to Europeans. The quest was to understand how these 'newly' discovered kingdoms might be made to fit into extant European understandings of God's intended order of things.

The establishment of the first botanic gardens proper in France, Germany, Italy and the Netherlands in the mid to late 1500s reflected a steady shift away from theological questions about the nature of plants. Expanding on their precursor — the physic garden — these early botanic gardens were dedicated to the early-scientific study of medicinal plants. By the 1600s, botanic gardens were well established as centres for training of medical doctors in the use of medical plants. Early medical doctors based much of their profession on mastering pharmacological concoctions for healing purposes. In this context, many botanic gardens were associated with universities, which further contributed to their establishment as sites of scientific pursuit. By the 1700s, medical schools became

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autonomous from botanic gardens. The study of plants in and of themselves became an autonomous field under the aegis of scientific botany. By the late 1700s, and especially under the influence of Linné's work at Leiden, botanic gardens became centrally concerned with the systematization of plant nomenclature, taxonomy, and propagation [16]. Many programs that combined scientific research with training university students in modern botany were developed. At this historical juncture, botanic gardens also focused on the study and classification of new plants that were introduced in Europe mainly through colonialism [17,18].

Throughout the 1800s and early 1900s, botanic gardens in Europe continued to play instrumental roles in the context of colonialism and empire building [19–22]. They developed the necessary know-how to facilitate plant adaption across different ecosystems and climates. This work of plant acclimatization was critically important to colonial nations seeking to solidify their domain across vast geographic areas in the global south [23]. It allowed nations to build crop-based economic empires that spanned the globe [24]. For example, the amazonian rubber tree that is native to areas that were once under Portuguese domain, was acclimatized to grow in areas in East India under British domain[25]. The latter became a monumental source of wealth for British entrepreneurs. Similar examples abound for including highly lucrative crops such cotton, coffee, and tea.

These processes were facilitated through the introduction of new technologies that allowed tropical plants to survive and thrive in the frigid climates of the global north. The most prominent of these inventions was the heated greenhouse which brought enormous advantage to these nation states. On the one hand, greenhouses afforded European nations opportunities to amass a vast array of living plants collected all over the world [26,27]. On the other hand, it accelerated the development of economic botany which studied the potential use of plants for profit [28]. This discipline operated alongside ethno-botany whereby traditional knowledge practices were also collected and housed in European botanic gardens.

As a whole, these practices brought great advantages to European nation states engaged in colonialism and processes of empire building [29]. Not only did they facilitate the exchange of plant materials on a global scale, they also promoted the centralization of invaluable plant knowledge within botanic gardens [30]. Many gardens in the global north now possess large archival collections that still house these materials [31,32].

3. The Re-Invention of Botanic Gardens in the Age of Biodiversity Conservation and Post-Colonial Dynamics

In recent decades botanic gardens have been engaged in the process of reconstituting themselves as organizations of plant biodiversity conservation [33–36]. This shift began in the 1970s in response to the rise of environmental movements of the 1960s. It was consolidated with the establishment of Botanic Gardens Conservation International (BGCI) in 1987 [37–39]. BGCI operates as an umbrella organization that brings botanic gardens and kin institutions around the world into a network of collaboration to preserve plant ecosystems on a planetary scale [40]. For example, BGCI has spearheaded the creation of Global Strategies for Plant Conservation (GSPCs) in step with the Convention of Biological Diversity (CBC). It implements an operational framework that guides a wide range of local, national, and international stakeholders in pursuit of plant sustainability. The GSPC encompasses five key thematic priorities. They are: 1) the understanding, recognition, and documentation of plant diversity; 2) the urgent and effective conservation of plant conservation; 3) the sustainable and equitable use of plant diversity; 4) the promotion of education and awareness of plant diversity, as well as the role of plant diversity in sustaining livelihoods and life on earth in general; 5) development of the necessary capacities and public engagement for the successful implementation of the GSPC. As a subset of the GSPC, many countries have developed National Strategies for Plant Conservation (NSPCs) that implement the GSPC with attention to national and regional plant diversity ecosystem dynamics.

These transformations have had a major impact on the core missions of botanic gardens [41]. On one hand, botanic gardens have developed and expanded biodiversity research and conservation mandates. In some cases, this includes the creation of entirely new science departments that rely on

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new technologies and expertise, as well as greatly expanded approaches to the training of personnel with expertise in plant conservation science. On the other hand, at the end of the first decade of the new millennium botanic gardens began to embrace social missions as a form of engaging wider audiences in socio-ecological sustainability [42]. The focus of these projects ranges from knowledge dissemination to lay audiences, the promotion of urban food security, to the preservation of cultural diversity as inextricably linked to biological diversity.

Alongside these transformations, many new kinds of botanic gardens have been founded throughout the 20th century and early 21st century. In contrast to the European historical and colonial model, many of these new gardens have been created to serve a multitude of purposes that are not restricted to scientific endeavours. This includes, for example, the preservation of local/traditional forms of plant knowledge and use, or the restoration of indigenous practices of environmental stewardship [43]. From this perspective, the contemporary botanical garden institution is far more widely encompassing and inclusive than that of their former euro-centric counterpart [44].

The dynamics that once characterized relations between botanic gardens in the global north and botanic gardens in the global south have also changed considerably with the independence of former European colonies. Greatly as a result of this, engagement with colonial legacies is becoming increasingly important within the botanic garden institution [45]. Leading botanic gardens such as, for example, Royal Botanic Gardens KEW or the Royal Botanic Gardens Edinburgh in the UK, are reshaping the nature of their collaborations with gardens in nation states that were once integrated in the British imperial domain. Principles such as reciprocity and equity have been embedded in new collaborations between gardens in the global south and the global north. These principles translate, for example, into practices meant to assure that both stand to gain from collaborative processes. Moreover, new debates are emerging on whether or how botanic gardens may engage with decolonization mandates that dismantle historical hierarchies and power differentials that allowed for the extraction of plant materials and knowledge from the global south, and their concomitant appropriation to serve the interests of colonial rulers [46].

A key item of discussion in this context refers to the power dynamics that currently take place in biodiversity research and conservation initiatives [47]. While the current ethos is to develop equitable and mutually beneficial partnerships, there is the risk that former colonial dynamics are reproduced — however unintended this may be. To counter this risk, better recognition of the importance of lay expertise and respective knowledge practices, as well as matters of intellectual ownership, are of great importance in decolonization debates [48]. Some botanic gardens are also beginning to rethink the status of archival collections obtained through colonial rule. This can pose considerable challenges, but can also offer exciting possibilities [49].

4. Contemporary Missions of Botanic Gardens

The transformations that took place in the latter part of the 20th century and early 2000s are reflected in the revision of the historical mandates of the botanical garden institution [50]. These include the development of new orientations for scientific research and the reconceptualization of horticulture at botanic gardens to serve purposes of biodiversity conservation. In turn, new missions have emerged as botanic gardens take on new social roles [51] and shift toward a more widely inclusive engagement with their audiences.

4.1. Science, Research, Horticulture, Education, and Conservation

Scientific and formal educational activities remain a key mandate at many botanic gardens [52]. For BGCI, the conduct of science remains a defining trait for the recognition of botanic garden institutional status. Within this framework, scientific botany has retained its historical importance as science departments continue to study plant structure and physiology, distribution and classification. However, whereas medicinal, economic, and ethno-botany were a central activities at earlier botanic gardens, contemporary botanical research tends to prioritize matters of environmental sustainability. This includes research on plant genetics, propagation, ecosystem dynamics, plant diversity, biodiversity conservation, and adaptation to the planet's changing climate.

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The development of novel methods and technologies for the study of plants and plant ecology has also impacted the ways in which plant science is carried out at botanic gardens. The study of plant ecology and reproduction accelerated exponentially in recent decades with the development of theoretical modelling. These innovations allowed scientists to explore multi-scale interactions over time among plant genetics, ecology, pollination, and reproductive system evolution. They "paved the way for a large number of experimental studies in the laboratory and field, merging pollination biology, quantitative genetics, comparative biology, phylogenetics, population genetics and, most recently, genomics"[53] (p. 999) .

The adoption of new scientific methods and technologies at botanic gardens (such as advances in DNA techniques), has enhanced their potential contribution to the mitigation of climate change. For instance, DNA research can identify the role that specific genes may play in rendering plants better adapted to withstand drought and hotter climates. These studies have the potential to support the alteration of plant genetic material toward greater resiliency in a world where average temperatures are expected to continue to increase. While these developments could be of great importance for the future sustainability of agriculture, these research activities also carry the potential for significant economic impact — especially for the nations leading such research.

When it comes to plant DNA material, some botanic gardens host invaluable collections not only in the form of living plants, but also stored in herbaria. These archives contain samples of plants that are currently threatened or even extinct, but which still harbour genetic material that could eventually be of use. A large number of the herbaria that were produced in the past 400 years are stored at botanic gardens in the global north. The use of genetic material stored in herbaria raises questions about the politics of the colonial frameworks within which they were collected. The content that now rests in herbaria was often extracted via inequitable colonial relations that favoured the interests of colonial rulers in unequal systems of exchange and/or forceful extraction. At a juncture where decolonization is increasingly recognized as an important socio-political issue, the question becomes- who gets to make decisions about, and benefit from, the use of herbaria in contemporary science, as well as who stands to gain from its applications and how.

As institutions of cutting edge research, some botanic gardens are accredited centres of teaching and learning from entry levels all the way to the highest levels of graduate study. A large majority of botanic gardens provide educational programs for lay audiences that include both children and adult learners [54]. These programs cover a very wide range of learning possibilities, from teaching children the basics of plant seeding and growing, to teaching adults how to combine the pursuit of ornamental aesthetics, food security, and biodiversity. As accredited institutions of formal training and teaching, botanic gardens also offer a wide portfolio of learning possibilities at undergraduate, graduate, and post-graduate levels. This is particularly true of botanic gardens that are associated with universities.

In the past, scientific knowledge practices at botanic gardens were favoured over informal lay knowledge practices — often referred to as traditional ecological knowledge [55]. The latter was often dismissed as not relevant, or rendered invisible beyond the archives into which they were collected. This is ironic if one considers that a great deal of what is now recognized as scientific knowledge within the history of botanic gardens was developed with the help of local inhabitants in colonial territories. In recent years, however, the value of the kinds of lay expertise have been recognized as crucial in the support of contemporary biodiversity conservation [56]. Scholars have shown that cultural diversity is intimately associated with the preservation of biological diversity. While there is still great need to widen awareness of these associations, the complementarity of lay and scientific expertise is increasingly recognized as a vital aspect of global biodiversity conservation — including at botanic gardens.

Alongside these developments, horticultural activities have retained their prominence at botanic gardens. This constitutes no surprise. The practice of cultivating and tending to plants, has been a central feature of the botanical garden institution since its inception. To this day, ornamental displays attract a large percentage of people who visit these gardens. They are a key source of revenue at botanic gardens, and one of the major drivers in the continuing expansion of the garden tourism

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industry. The instrumental role that horticulture plays in relation to science endeavours at these institutions, however, is far less visible to the average visitor despite the existence of interpretation materials that highlight these contributions.

To be sure, scientific investigation and horticulture continue to go hand in hand at many botanic gardens. It can be said that horticulture is the applied dimension of plant science [57]. This role is exceedingly important in the context of biodiversity conservation and climate change mitigation and adaptation. Experts trained in horticulture are often tasked with the challenge of finding ways to reproduce and propagate plants that have not yet undergone processes of 'domestication'. This is highly important work in cases where specific plant species are nearing extinction, as well as in the context of ecological restoration projects. Horticulturists also possess the necessary expertise to work on the strategic reproduction of specific plants with the goal of selecting traits that render these plants more resilient to specific contextual alterations, and therefore more adaptable to changes in climate and/or ecosystem dynamics.

As an extension of all of these activities, botanical garden biodiversity conservation materializes in two main forms. They are in situ conservation and ex situ conservation. Translated from Latin, in situ means 'in place'. It refers to conservation done within ecosystems with the goal of preserving and/or restoring plants in the endemic settings from which they evolved [58]. Ex situ refers to the conservation of plants outside their original ecosystems. More often than not, this refers to the plant collections that are held at botanic gardens. Many are plants extracted and collected from a variety of locations around the world. Typically this is the case of botanic gardens situated in nations that were former colonizers as described earlier in this article.

In situ and ex situ conservation practices are often mutually supportive [59]. It is not uncommon for botanic gardens to rely on plant collections that they host ex situ for the reproduction of specimens that go into restoration initiatives in situ. It is important to note that this can entail plant species that are considered all but extinct with only a few specimens remaining in existence ex situ [60]. This reality has led to new and exciting collaborations among botanic gardens in the global north and botanic gardens in the global south [61]. Highly important — and successful — biodiversity conservation and restoration initiatives have taken place in this context [62,63]. Nevertheless, questions can emerge about the potential for power imbalances to develop between botanic gardens which inadvertently reproduce dynamics that echo those that characterized former colonial relations [64]. For example, collaborations between gardens could entail the extraction and centralized storage of knowledge practices in inequitable fashion. Gardens operating within a decolonial framework are particularly attentive to such possibilities and engage reflexively in means to avoid their occurrence [65]. KEW gardens has pioneered the digitization of its archives and collections as a strategy to making these resources more widely accessible and therefore rendering knowledge sharing practices more equitable.

4.2. Social Engagement and SDGs

At the dawn of the new millennium, botanic gardens began to expand their approaches to plant biodiversity to also include engagement with socio-cultural issues pertaining to environmental sustainability [66–71]. A 2010 landmark report commissioned by BGCI, the Leicester study [72,73], was a turning point in this context. It identified possibilities for new forms of botanical garden engagement with general audiences, and how these goals might be achieved [74]. The report's core focus was the UK, but many of its conclusions are applicable to a vast array of botanic gardens beyond Europe and the global north.

The study drew attention to untapped potential at botanic gardens. It suggested that botanic gardens could play more prominent roles in educating general audiences on the importance of preserving plant biodiversity, in reconnecting people to plant worlds, and in providing greater insight into how citizens might themselves contribute to plant preservation [75,76]. The study recommended that botanic gardens achieve these objectives by working "in partnership with their local communities and addressing contemporary concerns like climate change" (Towards a New Social Purpose: 2). Moreover, the study indicated that botanic gardens could facilitate the

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materialization of key goals in the Global Strategy for Plant Conservation (GSPC) by collaborating with communities of lay experts beyond the walls of the botanical garden. At the time of the study, many botanic gardens had amply demonstrated their capacity to tackle aspects of the GSPC that require scientific expertise in plants and plant ecology. One of the chief outcomes of the Leicester study was to show that botanic gardens could *also* make crucial contributions to GSPC mandates that require attention to socio-cultural dimensions of biodiversity conservation.

One of the additional contributions of the Leicester study was to unveil challenges that confronted botanic gardens in the UK and most likely shared by many of the classic botanic gardens in Europe. The main problem revolved around audience perceptions of historical botanic gardens as inward looking, elitist institutions that implicitly reflected the sensitivities of 'white, middle class, older' visitors. The presentation of plant nomenclature in Latin and the communication of science in technical language were examples of practices that sustained the image of botanic gardens as unwelcoming to visitors from distinct backgrounds and with distinct motivations. The recommendation that came out of the Leicester study was that botanic gardens ought to strive to become more socially inclusive and equitable and rethink their core missions accordingly.

It is important to note that given its UK focus, the Leicester study was not mandated to explore and account for botanic gardens beyond the European context. As such, it does not include botanic gardens that have — from their inception — been dedicated to carrying out socio-cultural ecological missions. In the global north, the Montreal Botanical Gardens in Canada, founded in 1933, is an early example of this trend. In turn, a large percentage of the botanic gardens that were inaugurated throughout the global south between 1992 and 2023 and dedicated to biodiversity conservation seem to include social roles at their core [77]. The latter is in fact captured in BGCI publications that provide detailed accounts of the richness and variety of projects in existence globally. These botanic gardens carry out critically important work in pursuit of socio-environmental sustainability. Arguably, this helps explain the more general resiliency of the botanic gardens in the 21st century and their proliferation in the global south.

The Leicester report was unambiguous in its position that the future survival of the botanic garden institution might very well depend on its ability to remain socially relevant in the context of growing concerns with our planet's environmental status and related matters of global inequity. Alas, the report also acknowledges that the capacity to do so varies greatly among different botanic gardens along the lines of financial resources, institutional willingness and/or know-how and location. This is a highly consequential state of affairs, especially for botanic gardens that face difficulties in transforming themselves to adapt to new historical demands — whether it is due to lack of resources, or to internal divisions within botanic gardens concerning the conceptualization of the institution's future.

In response to the Leicester findings, and noting that the conservation of plant diversity "is intrinsically linked to global issues including poverty, human well-being and climate change" [78](page 2), BGCI invited botanic gardens to re-imagine their philosophies, missions, and practices accordingly. Success in obtaining a grant from the Calouste Gulbenkian Foundation, added momentum to BGCI's efforts in this context. It provided the financial resources for BGCI to launch an initiative that sponsored 6 pilot projects at botanic gardens in the UK (https://www.bgci.org/our-work/projects-and-case-studies/communities-in-nature-growing-the-social-role-of-botanic-gardens/). These experimental projects were to be assessed as a baseline for expanding botanical garden social engagement on a much larger scale through BGCI's global network. Titled "Communities in Nature" the pilot program ran from 2010 to 2015 and was highly successful. It demonstrated that botanic gardens can *de facto* develop and implement activity programs that engage communities meaningfully and productively to achieve goals that simultaneously serve social and environmental purposes [79]. Building partly on the project's success and lessons learned, BGCI was indeed able to scale up the approach to a global level and it "resulted in this approach being embraced as a foundation to all of BGCI's public engagement work" (same link).

Between the global expansion of the number of botanic gardens that were founded to serve socio-environmental roles, and the adaptation of older 'traditional' botanic gardens to these

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purposes, the botanical garden institution has taken on a particularly significant role in relation to the United Nations's Social Development Goals (SDGs) [80]. In the words of Dr. Paul Smith (BGCI Secretary General) in a 2018 editorial for BGCI's flagship journal, botanical gardens have approached SDGs by "highlighting the intersections between plant diversity and sustainable development" [81](page 2). In the same edition, Suzanne Sharrock (Director of Global Programs BGCI) provides an illustrative table with examples of the impressive array of contributions that botanic gardens have achieved in this context — which cover all 17 SDG goals. From the goal of ending "poverty in all its forms everywhere" (SDG1), through ending hunger and achieving food security while promoting sustainable agriculture (SDG2), to reducing "inequality within and among countries" (SDG 10), or take action to combat climate change and its impacts (SDG 13) — to name but a few.

Although many botanic gardens in the global north and in the global south continue to grapple with the histories and legacies of European colonialism, with financial strife, and with the challenges of deepening environmental crisis, the successful adoption of new social-environmental roles has endowed botanic gardens with renewed contemporary relevance. It attests to the continued resiliency of this institution after 400 years of historical adaptations and transformations.

5. Concluding Thoughts

The botanical garden is a resilient institution that has adapted to a multitude of historical transformations. There is good reason to expect that botanic gardens will continue to play important roles in promoting the conservation of plant biodiversity, and in helping nations around the world adjust to climate change. The success of the botanical gardens institution in this context will very likely depend on its its ability to continue to bridge socio-cultural realities with ecological dynamics. To be sure, there is growing consensus that the complexity of environmental problems like biodiversity loss and climate change calls for greater holism as a move beyond reductionist approaches to 'society' and 'nature'. In so doing, botanic gardens will align with globally leading institutions of environmental governance such as The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the UN Environment Programme (UNEP), while continuing to offer unique sets of expertise in the preservation of socio-cultural and biological plant worlds.

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