AMERICAN UNIVERSITY OF BEIRUT

GUIDELINES FOR ESTABLISHING ANCILLARY BOTANIC GARDENS

by
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AN ABSTRACT OF THE THESIS OF

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Ancillary Botanic Gardens (ABGs) are proposed as a new category of botanical learning venues to mitigate decreasing financial and spatial opportunities for the establishment of formal botanic gardens. ABGs are established in any open green space that has existing levels of land protection owing to its primary purpose such as, educational institutions, private institutions, touristic sites, and archeological sites. ABGs seek to engage the stakeholders and larger part of taxonomically illiterate members of society in conceiving and establishing botanic gardens by relying on local nomenclature, common names, or by collaborating with educational institutions. By engaging people from various sectors and backgrounds in establishing ABGs, 'nature' is promoted and valued from different perspectives.

The objective of this study is to facilitate the establishment of ABGs by developing guidelines that align the transformation process of the space following guidelines that are benchmarked against botanic garden institutions. A content analysis of botanic gardens featured in a global database was conducted to build a list of all botanic garden features, including elements and facilities.

The results showed that there are 36 recurring elements in botanic gardens, many of which provide recreational and educational services to visitors. In addition, there are 12 facilities that are repeatedly found and necessary for the operation of botanic gardens. Guidelines were developed by organizing the elements into themes, and by providing a detailed description of each element following a photo-analysis of images representing each element using google images search.

The proposed guidelines were then tested on three ancillary botanic garden case studies namely an estate consisting of traditional old agricultural terraces recently converted into an organic farm, a private home garden constituting one of the oldest estates in Beirut, and a private high school campus.

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ABBREVIATIONS

ABG Ancillary Botanic Garden

BGCI Botanic Garden Conservation International

CBD Convention on Biological Diversity

GSPC Global Strategy for Plant Conservation

IUCN International Union for Conservation of Nature

NA Not Applicable

NBSAP National Biodiversity Strategy and Action Plan

UNEP United Nations Environment Program

UNFPA United Nations Population Fund

CHAPTER I

INTRODUCTION

Humans have made much of the world uninhabitable to other organisms, and half of the world's population that now lives in cities feels increasingly disconnected from nature (UNFPA, 2017; Wandersee & Schussler, 1999). Within a short lapse of time, the lifestyle of urban residents changed drastically, as they witnessed a transition from a life predominantly spent outside, to a life spent inside buildings (Lehmann, 2019). Urban residents are experiencing "plant blindness" or the inability to notice plants; plants are taken-for-granted and considered lifeless (Wandersee & Schussler, 1999; Wilkins, 1988). The widespread lack of awareness of plants is further aggravated by the popularity of technology-saturated distractions in indoor settings like video games, home movies, and internet usage, leading to a significant disconnection from nature (Worpole, 2000).

With the increasing loss of biodiversity and rapid urbanization of human populations, the need for institutions dedicated to the conservation of plant biodiversity and education of urban residents become much stronger. Botanical education is proposed as one solution which can change the 'defective worldview that is constantly creating the social world and progressively destroying the natural one' (Slaughter, 1996).

Botanic gardens offer botanical education (Wandersee & Schussler, 1999). They are maintained collection of plants, usually documented and labeled, and open to the public for the purposes of conservation, education, research, and recreation (Houston, 2009; Wyse Jackson & Sutherland, 2000; Byrd, 1989). They provide the botanical

education needed to mitigate the effects of plant blindness and influence positively the visitors' environmental attitudes (Williams, Jones, Gibbons, & Clubbe, 2015; Wandersee & Schussler, 1999). However, significant financial challenges lie ahead for botanic gardens; their ability to raise funds from visitors is limited because they are already perceived as luxury spaces that cater for an exclusive class of citizens (Williams et al., 2015). These financial problems along with the high real estate value in cities are deterrents for individuals and institutions who seek to establish new botanic gardens. To address these shortcomings, Talhouk, Abunnasr, Hall, Miller, and Seif (2014) proposed a new concept of botanic gardens, ancillary botanic garden (ABGs), that is based on the transformation of existing green spaces, belonging to different institutions or individuals (such as educational, private, touristic, religious, and historic sites), into botanical education venues.

Unlike planned botanic gardens, ABGs are informal, not prescribed; they are conceived, planned, managed by local communities/institutions, and retrofitted into open spaces owned by diverse institutions. This transformation process requires guidelines to facilitate the development of the space into an ABG, and at the same time ensure that the ABG is physically and operationally aligned with formal botanic gardens.

Our study seeks to support the establishment of ABGs by addressing the following research question: What aspects of botanic gardens inform the establishment and development of ABGs? The thesis will address this question by conducting an extensive analysis of existing botanic gardens, it will develop guidelines to guide the establishment of ancillary botanic gardens, and it will test the applicability of these guidelines on three case studies.

CHAPTER II

LITERATURE REVIEW

A. Urbanization and the disconnection from nature

Urbanization is described as an increase in human habitation, and continuous, rapid and colossal population movement from rural to urban areas (Kojima, 1996). In 1950, one-third of the world population resided in urban areas, while currently half of the global population lives in cities, in 30 years, two-thirds of the world's population is expected to be living there (UNFPA, 2017). The urbanization process has become a global issue because it has been occurring in nearly every part of the world inhabited by humans (Hussain & Imitiyaz, 2017). Urbanization and its consequent vast and dense agglomerations comprising the urban population lead to a change in the economic, social and cultural facets of the society (Hussain & Imtiyaz, 2017). It is often linked with increased per capita energy and resource consumption, and extensive landscape modification (McDonnell & Pickett, 1990). But most importantly, it leads to a degree of disconnection between urban dwellers and nature. As people live more urbanized lifestyles, there is a potential to lose daily contact with nature, decreasing with it the access to the full range of associated benefits of interacting with nature (Cox, Hudson, Shanahan, Fuller, & Gaston, 2017). Connectedness to nature is vital because it leads to concern for nature; if people feel connected to nature, then they will less likely harm it (Mayer & Frantz, 2004). 'On the other hand, ignorance of nature leads to a lack of interest and care for it' (Gelsthorpe, 2017). Having a connection to nature is often linked to better environmental identity and improved health and well-being. Children who are disconnected from nature and tend to be kept inside occupied with structured

activities are less healthy and generally have a lower quality of life from children who engage in nature (RSPB, 2010). Chronic or non-communicable diseases such as depression, cancer, cardiovascular disease, and diabetes are the leading cause of death globally (Gelsthorpe, 2017). Many of these non-communicable diseases are connected to the peoples' lifestyle, including physical inactivity, poor diet and chronic stress, which are growing problems in urban areas (Gelsthorpe, 2017). The lack of green space around the urban residents seems to contribute to this as those who live near green space are 25% more likely to be physically active than those who do not (Richardson & Parker, 2011). Within a short lapse of time, people have experienced a transition from a life predominantly spent outside to a very different life inside buildings. People have changed their way of living, and this resulted in a complete change in their relationship with nature (Lehmann, 2019).

B. Plant blindness

Wandersee and Schussler (1999) introduced the term "plant blindness" to describe the widespread lack of awareness of plants between urban dwellers. According to Wilkins (1988) "plants are the most important, least understood, and most taken-for-granted of all living things." Many people consider plants to be lifeless especially urban dwellers, who are not regularly in direct contact with plants, and who look at animals more regularly than plants (Wandersee & Schussler, 2001). Generally, plants do not get visual attention due to some visual principles that were elaborated by Wandersee and Schussler (2001);

- Plant species are static; they are classified as 'bulk visual categories' because they do not move, except in the wind (Zakia, 1997).

- Plants blend in with the background. Leaves of non-flowering plants get lost in the 'chromatic homogeneity.' Only colorful flowering plants might catch the attention of the observer.
- Plants do not change color rapidly; color is an important pattern for the brain to structure visual experience (Zakia, 1997; Wandersee & Schussler, 2001). However, it is worth noting that plants change dramatically with the seasons, more dramatically than animals in most cases and unlike animals, plants often possess pleasant fragrances (Hershey, 1993)
- Plants are harmless, even direct contact with them does not lead to any health issues as opposed to animals who might cause health threats. Therefore, people do not pay much attention to them.

In addition to the above arguments, Allen (2003) affirmed that plant blindness and neglect is not only due to the above biological and social biases stated by Wandersee and Schussler (2001), but it is often the result of educational biases such as zoo-chauvinism practiced by biology educators at all educational levels, who tend to use animal examples to teach basic biological concepts.

C. Environmental education and botanic gardens

Today, urban residents have a much different relationship and understanding of the natural world. To reverse the trend of declining nature experiences, environmental and botanical education need to be addressed in our modern societies as environmental education changes our relationship to the environment.

A recognition of the need for urban environmental education emerged from UNESCO conferences in the late 1970s, which led to a series of influential policy statements that changed the concept of the environment from 'nature' to include the

‘urban environment.’ In order to create an environmentally-educated society, a new approach is desired which constitutes creating synergy between the school and the community, in this way education is not inclusive to school and colleges, but it comprises the community, and that is what we call an informal environmental education. Informal education, as defined by Bell, Lewenstein, Shouse, & Feder (2009), is “characterized as learner-motivated, guided by learner interests, voluntary, personal and open-ended.” Nowadays, many of the environmental education happens in informal settings (Freeland, 2017). However, the ultimate learning experience would be through the creation of bridges between formal and informal education. Perhaps the most straightforward approach that encompasses formal and informal education is through the creation of botanic gardens which increase both direct and incidental interactions with nature. Botanic gardens are places where plants can be collected, cultured, and studied for scientific and display purposes (Byrd, 1989). A more recent definition could be that a “botanic garden” is a maintained collection of plants, usually documented and labeled offering multiple uses and programs ranging from collections and scientific research to education, to recreation (Byrd 1989; Wyse Jackson & Sutherland 2000; Houston, 2009). Smith (1990) states that “botanic gardens have a significant role to play in developing appropriate attitudes and behavior that may ultimately be responsible for saving the earth.” The existing continuum of public spaces ranges from types that focus purely on human needs, such as public parks, to those that focus on science and ecology, such as ecological restoration sites. Botanic gardens fall at the center of this continuum, mediating between human experience and scientific understanding (Hohn, 2008). The role of education is becoming significant as gardens move into the 21st century and the concept of Anthropocene gains grounds. Botanic gardens, like zoos and

natural history museums, provide repositories of living organisms that can also evoke a sense of relationships within ecosystems (Sanders, Ryken, & Stewart, 2018). Educational initiatives in such settings can offer opportunities to revisit complex questions about human relationships to, and impacts on, other species (Sanders et al., 2018).

D. The evolving role of botanic gardens

From their early days, botanic gardens have existed to connect humans with the natural world around them. At first, in the early 1500s, botanic gardens existed as physic gardens where the importance of medicinal plants was recognized. These gardens known as European Medicinal Gardens were established to grow and display plants for the training of medical students (Heywood, 1987). Later, in the late 1600s, botanic gardens switched to become Classic European Botanic Gardens. They continued to seek medicinal uses for plants, but they began to work at acclimatizing plants for growth in particular regions. Later, in the late 1700s, they became Colonial Tropical Botanic Gardens; they were vital components of trade as they brought seeds and fruits from distant lands, and became commercial undertakings intended to provide lumber, fruits, vegetables, and other products with economic potential (Heywood 1987; Mielcarek 2000; Sanders et al., 2018). During the mid-1800s, they converted to Civic and Municipal Botanic Gardens which were founded by governments (Heywood, 1987); these botanic gardens generally did not have any significant scientific or taxonomic programs, they focused more on public education and horticulture than science or research, and they emphasized aesthetics over research and education (Heywood 1987; Mielcarek, 2000). During the same period, Specialized Botanic Gardens appeared; these were specialized in a specific area of scientific research such as agricultural plants,

germplasm collections, medicinal plant research, native plants (Heywood, 1987). Today, the evolution of botanic gardens has continued as modern conservation botanic gardens are expected to address contemporary challenges through a holistic and integrated approach that includes education, conservation, research, and recreation. Today, according to Botanic Gardens Conservation International Garden Search database, there are about 3,571 botanical institutions worldwide. BGCI was established in 1987 to connect the botanic gardens of the world in a global network for plant conservation (BGCI, 2019a). BGCI has built GardenSearch the only global source for information on botanic gardens. The database includes information on over 3,571 botanical institutions worldwide and provides gardens with a visible web presence, even when they do not have a website (BGCI, 2019b). These institutions that are visited by schools, families, and that cater for community events, receive an estimated 250 million visitors (Sanders et al., 2018). Botanic gardens are "humanity's main scientific, aesthetic and social link to plants", they will continue to "reflect our evolving relationship with plants and the rest of the natural world", and they will "continue to remind us of the many wonders of life here on earth" (Johnson & Medbury, 2007; Sanders, 2010).

E. The need for new botanic gardens

Concerns regarding the world's environment have led to the development of international cooperation on environmental issues. For instance, comprehensive international frameworks such as the Convention on Biological Diversity (CBD) have been developed to guide countries when formulating their national policies to meet conservation goals and fight biodiversity loss (Puppim de Oliveira et al., 2011). The CBD is an international treaty that came into force in 1993 and changed the

fundamental concept of ownership of "biodiversity" from the "common heritage of humankind" to the "sovereign right" of each country. Thus, it made each nation responsible for regulating its own biodiversity (Puppim de Oliveira et al., 2011). Under the terms of the CBD and the Global Strategy for Plant Conservation (GSPC) 2011–2020, countries have international obligations to first document their plant diversity, second conserve it and lastly preserve the cultural knowledge associated with their native plants. One way to conserve national plant diversity is by establishing botanic gardens (Talhouk et al., 2014). Botanic gardens are leaders in the implementation of the GSPC as they contribute to two targets; target 8 of the GSPC which requests that 75 percent of threatened plants to be accessible in ex-situ collections, preferably in the country of origin, and target 14 which insists on the importance of plant conservation and the need to incorporate communication, education and public awareness programs as part of the conservation strategy (Williams & Sharrock, 2010).

Today there are more than 2,900 botanic gardens worldwide. According to a general overview of the geographic distribution of botanic gardens by Talhouk et al. (2014), the largest number of botanic gardens are in the European Union, and many of those outside the EU were established following the colonial tradition of creating European-style botanic gardens. These findings conclude that despite the calls initiated by the CBD and GSPC for ex-situ conservation, the establishment of botanic gardens remains rather limited geographically. For instance, the distribution of botanical institutions across the world is limited; even the most biodiverse areas such as the tropics have a low number of botanic gardens compared to their species richness. One reason may be that the perceived importance of a botanic garden and the resulting intellectual, political and financial support necessary to establish and sustain it is rooted

in a historical colonial Eurocentric culture that is not globally shared or adopted (Talhouk et al., 2014). For example, countries of the Arab League have the lowest number of botanic gardens, the lowest number of gardens per total area and the lowest number of gardens per number of individuals. These findings highlight the need to broaden participation in ex-situ conservation and encourage the establishment of botanic gardens worldwide. Yet it is difficult to justify the need for a botanic garden where land and financial resources are limited, and the real-estate value is high. Establishing a botanic garden nowadays is much more complex than the past, especially that the lands are not readily available as they were. Today, the idea of appropriating land to establish botanic gardens and dedicate financial resources to manage such institutions is considered to be unjustifiably expensive initiative (Talhouk et al., 2014). Land value is very high in cities and priorities are given to urban development projects. Accordingly, a botanic garden is not enough of a priority to set aside land specifically for this purpose as it cannot compete with other land use options that may be more profitable such as touristic resorts. Yet such gardens are important to help safeguard the national floristic diversity.

Given these issues, alternative venues need to be examined to encourage the establishment of botanic gardens. One solution could be establishing botanic gardens as a secondary function of sites and employing in them local nomenclature that is vital for effective local communication and engagement (GSPC Target 14; the importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programs). While scientific plant nomenclature is vital for providing a stable international standard for communicating information about plants, local naming is equally important for engaging and enthusing local people who

are largely unfamiliar with a culturally alien system of Aristotelian types and Linnaean binomials (Talhouk et al., 2014).

F. Ancillary Botanic Gardens

Given the above shortcomings, Talhouk et al. (2014) proposed the recognition of a new category of botanic gardens termed ‘ancillary botanic gardens’ (ABG). ‘Ancillary botanic gardens are secondary on a spatial level in that they are established on peripheral areas of sites already assigned a primary purpose. They occupy unbuilt land or green spaces associated with sites such as archaeological sites, universities and schools, private institutions and touristic sites. Once a peripheral land opportunity is identified, the objectives guiding the planning, design, and establishment of an ABG include no or minimal interference with the primary function of the site. These sites are managed and accessible to the public but are practically restricted and protected through specific legislation and policies. Interestingly, ABGs are grounded in grassroots knowledge and rely on local nomenclature for effective local communication and engagement, both of which are fundamental in developing the necessary enthusiasm for plant conservation and for facilitating the link between plants and people. They engage taxonomically illiterate members of society and acts as ‘custodians’ for traditional land management practices and ethnobotanical knowledge and promote local ‘nature’ as culturally valuable planned and managed by local citizens. ABGs can be dispersed throughout the country providing a diversity of environmental conditions in which plant response to climate change can be monitored along altitudinal gradients and thus contribute to global change research. A key aspect of ABGs is that unlike botanic gardens, their roles and scope are not benchmarked against international standards (BGCI, 2019a). ABG mandates, defined by immediate stakeholders, are flexible rather

than prescriptive This, however, should not lead to the conclusion that ABGs are ‘mere’ public parks or pleasure gardens because they are implemented following a locally driven mission. Besides the reasonable degree of permanence and openness to the public, ABGs can have a level of outreach and educational opportunity, but they need not have a scientific basis for the collections or proper documentation, ‘adequate’ labeling, and strategies to communicate with other gardens or undertake any research activities. As such the mandate of these ‘deregulated’ entities can be defined by immediate stakeholders (Talhouk et al., 2014).

CHAPTER III

MATERIALS AND METHODS

In the table below is a summary of the research strategy adopted to develop guidelines for ancillary botanic gardens (table 1). Briefly, information on all botanic garden constituencies was collected from online maps of BGCI botanic garden members featured in the BGCI GardenSearch database. The features include all landscape elements, plant collections, facilities that exist in a botanic garden. This was followed by the generation of detailed information about each feature (elements and facilities) based on a systematic selection of google images and interpretation of top five images. Implementable guidelines were developed following a detailed inspection of each image and the generation of technical information derived from a systematic set of questions. The guidelines were then tested on three ancillary botanic garden case studies.

Table 1. Research strategy for the development of ABG guidelines

Purpose	**Process**	**Method of Analysis**
1. Build a list of botanic garden features including landscape elements, facilities, and plant collections.	Selection of case study botanic gardens Content analysis of botanic garden maps	- Web-based search - Database analysis
2. Develop guidelines for each botanic garden feature.	Analysis of google search image	- Photo analysis
3. Assess and evaluate the proposed ABG guidelines.	Field testing of guidelines on ABGs	- Fieldwork / Case study

A. Selection of case study botanic gardens

As part of the preliminary research process, a comprehensive search of the literature was undertaken; no literature was found on guidelines for botanic gardens. Therefore, the best practice was to manually investigate the features present in botanic gardens to be able to develop criteria for botanic gardens. Database analysis was used as the primary data collection method. The Botanic Garden Conservation International (BGCI) Database "GardenSearch" was the only reference database used in this study. BGCI is a plant conservation charity that acts as a global network connecting botanic gardens (BGCI, 2019a). BGCI's website offers four exclusive global online database resources namely; GardenSearch, GlobalTreeSearch, PlantSearch, and ThreatSearch. GardenSearch database includes over 3,571 botanic gardens, gene/seed banks, zoological institutions, private collections, and networks (BGCI, 2019b). Four inclusion criteria were used to select from GardenSearch database the institutions that served as case study botanic gardens (fig. 1). Based on these criteria, an institution that:
1) is a botanic garden, 2) is a member of the BGCI network (hence compliant with global standards developed by the BGCI, which are the following: the botanic garden must have a reasonable degree of permanence, it must be open to the public and has an underlying scientific basis for the collections, with adequate labeling of the plants and proper monitoring and documentation of the collections (Krishnan, 2016)), (3) features a garden map on the institution's website, and 4) utilizes English, French, or Arabic languages, was included as a case study. Two hundred and twenty botanic gardens fit the inclusion criteria and constituted case studies.

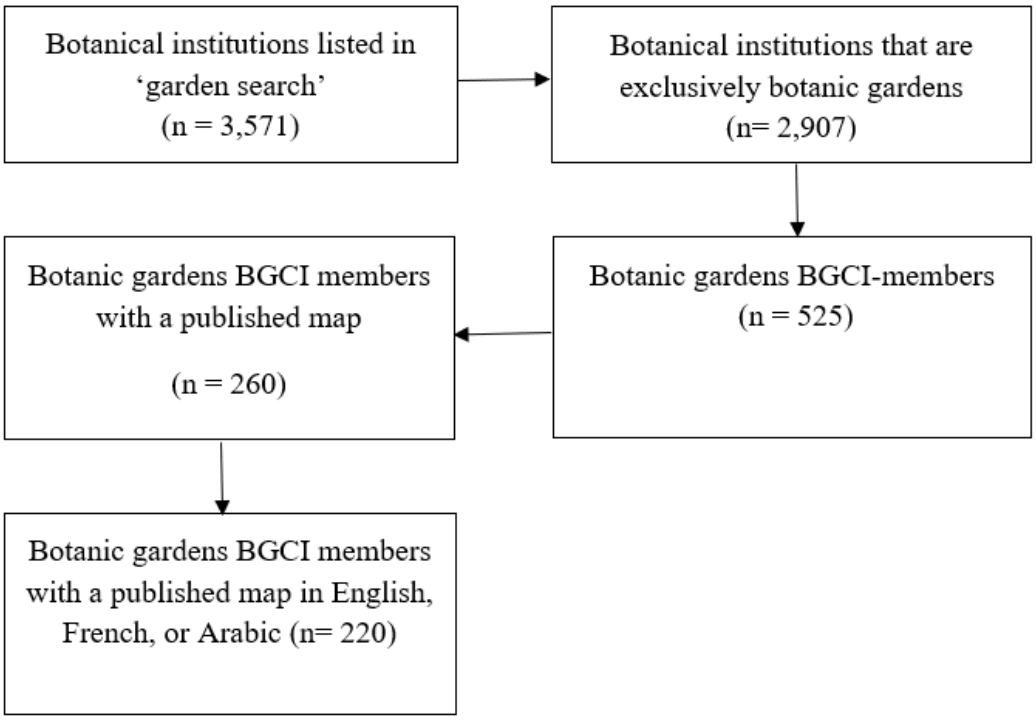


Figure 1. Criteria and selection process of case study botanic gardens

The following information was collected for each case study botanic garden: city, state, country, ownership status, date founded, total area, and website address. Websites of all case study botanic gardens were then visited, and garden maps were collected in pdf or jpeg format.

B. Content analysis of botanic garden maps

A list of landscape elements, facilities, and plant collections found in the case study botanic gardens was developed as follows: each botanic garden map was inspected visually, and all landscape elements, facilities, and/or plant collection featured in the map were recorded as an entry field (a column) in an excel spreadsheet. This process continued with all case study botanic garden maps until no new types of landscape elements, facilities, and plant collections were noted. All entries were then organized into thematic categories. The below figure (fig. 2) shows how the analysis of the maps was directed.

Figure 2. Naples botanic garden map inspected

The elements, facilities and plant collection in the botanic garden were extracted from the garden's map and recorded in two tables (table 2 & 3)

Table 2. Naples botanic garden's elements and facilities

Naples Botanic Garden	
Elements	***Facilities***
Cafe	Administrative building
Children playground	Parking
Event plaza/amphitheater	Restroom
Fauna	Ticket counter
Gift shop	
Lake	
Overlooking platform	
Pavilion	
Plant sales	
Research center	
Treehouse	

Table 3. Naples Botanical Garden's plant collection

Naples Botanical Garden	
Rain garden	**Thematic collection**
Children garden	
Water garden	
Succulent garden	
Brazilian garden	**Geographic collection**
Caribbean garden	
Asian garden	
Florida garden	

C. Guidelines for ancillary botanic gardens

After coming up with a list of elements and facilities present in botanic gardens, a photographic illustration analysis of landscape elements and facilities featured in the case study botanic gardens was developed by conducting a Google Images search. For every landscape element and facility, the keyword was used in combination with the words “botanic garden,” e.g., amphitheater botanic garden. In case the search did not yield results, a second round of search was conducted, and the element word was searched for independently, e.g., amphitheater. For every search, the top 20 hits (fig. 3) were inspected and the first five images which clearly showed the type of material used to construct the element, its relative size, its context location, circulation related to it, types of activities within it, and accessibility to it, were saved for further analysis.

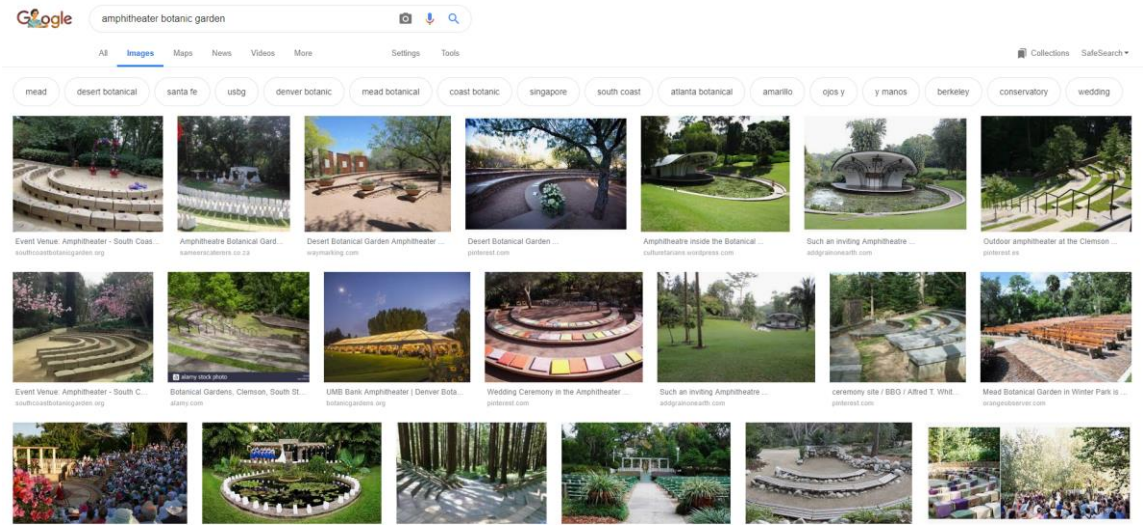


Figure 3. Top 20 Google image search sample (keyword amphitheater botanic garden)

Figure 4. Five selected Google images that show types of material used, relative size, context location, circulation, type of activities, and accessibility

The following questions shown in the table below were then used to guide the extraction of information from each selected image. For each element, the information compiled from all five images was consolidated in a table and then revised, put in text and further developed to constitute the guidelines.

Table 4. Photo-Analysis question guide applied to amphitheater botanic garden keyword search

Question	Observation for amphitheater
What are the materials used to construct the element?	- Softscape: trees, shrubs, grass… - Hardscape: benches, paved surface, railing, gravel or paved trail…

What is the size of the thematic element in meter square?	- Height - Width
Where is the element located?	- Embedded in trees - Outdoor, in an open space - Elevated - Overlooking - Indoor - Building by itself - Part of a building
How is the circulation organized within the entity?	- Wheelchair access - One level - Two levels - Stairs - Ramp
What do people do in the element?	- Stand - Observe - Rest - Eat - Walk - Jog - Sit
What is the main general program of activities in the element?	- Leisure - Educational - Facility
How is the element accessible in the garden?	- Part of the trail - Accessible from the trail
Is there any remarkable observation which was not included in the answers above? If so, specify.	- The element has a semi-circular shape…
Keyword search in google images search box	- Amphitheater - Amphitheater botanic garden
Source of the image (hyperlink)	

D. Field testing for guidelines on three ABG case studies

In order to test the guidelines, three case studies were selected. The case study sites were selected based on the following inclusion criteria: 1) the site represents an institution with sizable outdoor green space, 2) the site owner operation is already

benefiting directly or indirectly from vegetation on site, 3) the site owner has expressed interest in learning more about ABG and exploring the possibility of transforming their site into an ABG, 4) the project researcher purposely selected diverse institutions, an estate recently converted into an organic farm, a private home garden, and a private high school campus to test applicability of concept. For each field visit, a table of assessment (checklist) for site analysis and a list of recommendations explaining the findings were prepared. The table of assessment is divided into elements and facilities that were identified using the content analysis of botanic gardens. The table/checklist is essential for developing recommendations and building on the opportunities that will enrich the site as an ABG. Building on the checklist, a list of recommendations is developed to guide the owner who has expressed interest in establishing an ABG.

CHAPTER IV

RESULTS

A. General overview of botanical institutions listed in GardenSearch

Botanical institutions refer to botanic gardens, gene/seed banks, zoological institutions, private collections and networks (BGCI, 2019b). The BGCI GardenSearch database features 3,571 botanical institutions from 179 countries. Despite the broad scope of the database, results show that more than half of the listed botanical institutions are located in North America and Europe (BGCI, 2019a) (table 5). Furthermore, the number of botanical institutions per country is not even; for instance, botanical institutions in the USA constitute a quarter of the reported ones around the world (26%).

Table 5. Geographic distribution of botanical institutions in BGCI GardenSearch database

Continent	Number of Botanical Institutions	Percent of total institutions
Africa	190	5%
Asia	836	23%
Australia	183	5%
Europe	958	27%
North America	1163	33%
South America	241	7%
TOTAL	**3571**	

The number of botanic gardens featured in the GardenSearch is 2,910 constituting 82% of the database. The recorded number of BGCI-member botanic gardens is 525 from 89 countries (February 2019). However, ten percent of featured countries house half the reported BGCI-member botanic gardens (table 6).

Table 6. Distribution of BGCI-member botanic gardens per country

Country	**%**
United States of America	15
United Kingdom	8
Australia	5
Russian Federation	5
China	5
Germany	3
Italy	3
France	3
South Africa	3
Canada	2

More than 60% of BGCI-member botanic gardens are publicly owned with 51% state-owned and 12% owned by municipalities. Privately owned botanic gardens constitute 21% and 12% are owned by academic institutions (fig. 5).

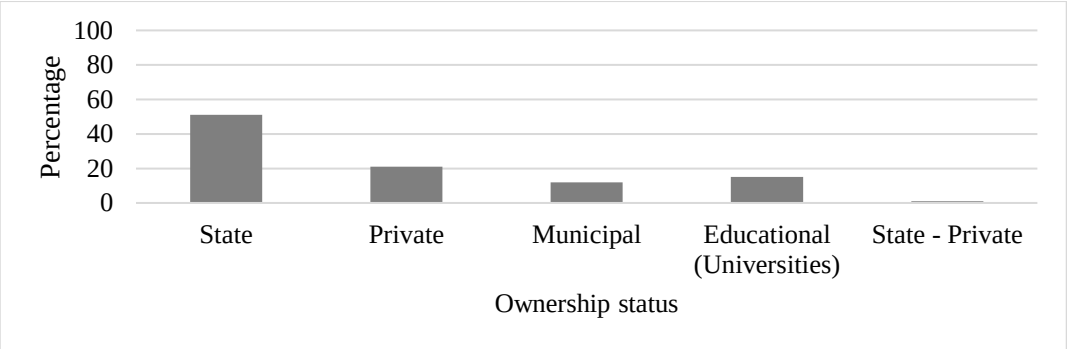


Figure 5. Ownership status of BGCI-member botanic gardens

The reported founding period of the BGCI-member botanic gardens aligned with historical periods and roles of gardens developed by Heywood (1987), and Sanders (2018) shed light on possible goals behind the establishment of these gardens as shown in table 7 and figure 6. The results, plotted over a 470-year time scale, show the rate at which botanic gardens have occurred from 1550 to 2018. According to the graph, group 4 & 5 have the highest rate of establishment of botanic gardens. The figure also shows that a large number of BGCI-member botanic gardens were founded after 1851, indicating that interests in community outreach and education may have driven their establishment.

Table 7. Founding date period and role of botanic gardens at establishment

	Founding period	Botanic Garden Role *(periods and roles according to Heywood, 1987; and Sanders, 2018)*
Group 1	1550 - 1680	European Medicinal Gardens
Group 2	1681 - 1780	Classic European Botanic Gardens
Group 3	1781 - 1850	Colonial Tropical Botanic Gardens
Group 4	1851 - 1960	Civic and Municipal Botanic Gardens Specialized Botanic Gardens
Group 5	1961 - Present	Botanic gardens focusing on education, conservation, research and recreation

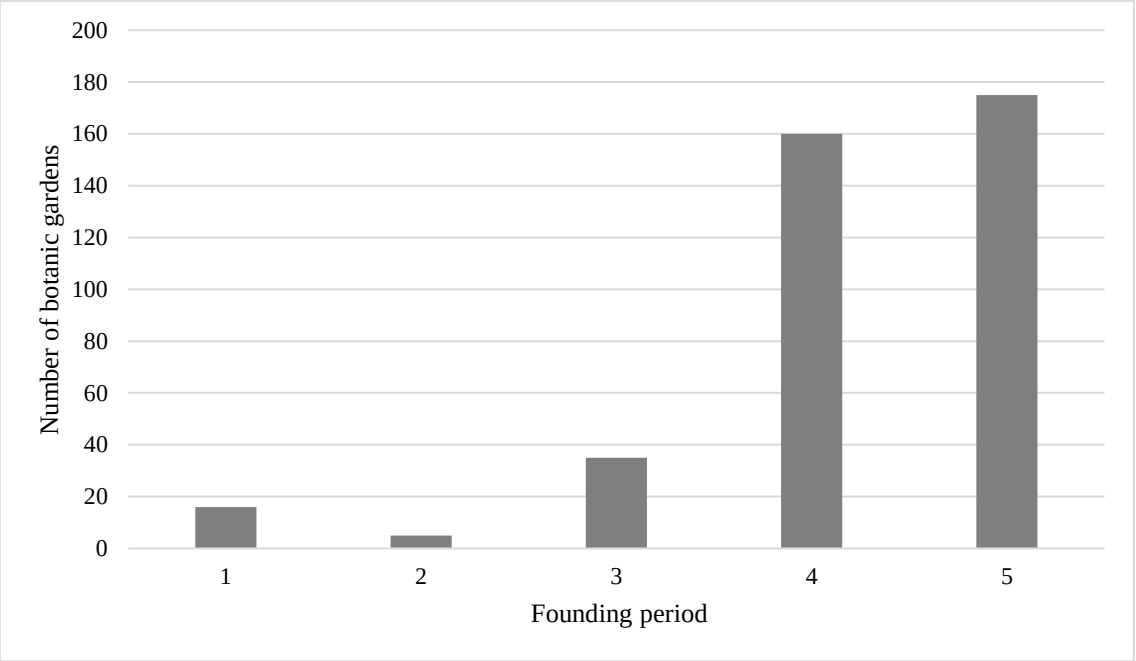


Figure 6. BGCI-member botanic gardens classified according to their founding date

BGCI-member botanic gardens sizes range from 1 Ha to more than 2200 Ha (table 8).

Table 8. Reported BGCI-member botanic gardens size categories. Total number of gardens featuring garden area is N=332.

Size category in Ha	Number of gardens in size category	Percent of gardens in size category
1	14	4.2 %
less than 10	116	34.9 %
11 to 50	108	32.5 %
51 to 100	39	11.7 %
101 to 200	31	9.3 %
201 to 1000	28	8.4 %
greater than 1000	6	1.8 %

The findings show that 4.2% of gardens are one hectare and a third are less than 10 Hectares. Only 20% are larger than 100 hectares (table 8). One garden is 2700 hectares, but in this specific case, the institution consists of a botanic garden and a zoo at the

same time. When comparing the size of the botanic gardens with their founding date, the findings showed that largest botanic gardens were established between 1890 and 1995 (fig. 7).

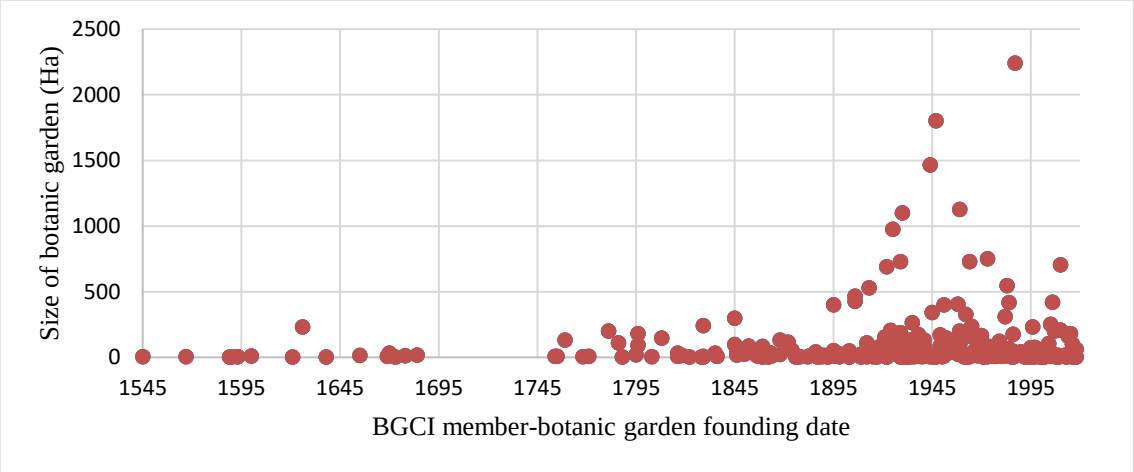


Figure 7. Reported BGCI-member botanic gardens sizes in relationship to the founding date

B. Elements and facilities in botanic gardens

Inspection of online maps produced by BGCI-member botanic gardens revealed the presence of living collections in botanic gardens. These collections fall under four main categories namely geographical, taxonomic, thematic, and ecological (BGCI, 2019c). According to BGCI, geographical collections consist of native plant collections from the surrounding region or national flora. Taxonomic collections focus on taxonomic groups. Thematic collections specialize in a limited range of related or morphologically similar plants such as orchids and roses, or plants falling under the same theme such as medicinal plants, bonsai, and butterfly gardens. Ecological collections focus on plants from one habitat or ecotype such as alpines or epiphytes. Two hundred and twenty of the case study BGCI-member botanic gardens reported

specific plant collections, with some gardens having more than one collection (table 9). Of the 350 plant collections in 220 botanic gardens, half were thematic, one third were geographic, and less than 10% were ecological or taxonomic.

Table 9. Types of plant collections in botanic gardens

Type of Plant Collections	Total Number of plant collections	Percent total recorded collection
Ecological	22	6.3 %
Geographical	118	33.7 %
Taxonomic	18	5.1 %
Thematic	192	54.9 %

Total number of case study BGCI-member botanic gardens reporting collections is 220, and total number of collections is 350.

Table 10 below lists the reported types of thematic gardens

Geographical	Thematic		Ecological	Taxonomic
African	13th century	Green roof	Aquatic	Fabaceae
Australian	Ancient plant	Herb	Alpine	Palmae
Bavarian	Animated	Heritage	Bog and heath	
Californian	Annual ornamental	Historic	Epiphytes	
Canary island	Aquatic	Jungle	Wetland	
Central American	Bamboo	Moon viewing	ecosystem	
Central and South	Bonsai	Moss	Dune ecosystem	
American	Bromeliad	Ornamental	Forest ecosystem	
Central Asian	Butterfly	Poisonous plants	Savannas	
Chilean	Camellia	Pond	Scrub	
Chinese	Cancer treatment	Rhododendron	Subtropics	
Coastal Zone	Children	Rock and water		
Eastern Asian	Circle	Rock		
European	Colonial	Rose		
German	Conservation	Ruin		
Japanese	Cottage	Scarecrow		
Madagascar	Courtyard	Scented		
Malesian	Cut flower	Sensory		
Mediterranean	Edible	Shade		
Mexican	Educational	Shakespeare		
New Zealand	Enabling	Succulent		

North American	Entry	Sun		
Ogasawara Islands	Evolution	Tea		
Pacific	Exhibition	Teaching		
Siri Lankan	Fern	Tennis court		
South African	Festival	Vegetable		
South American	Floral	Vertical		
South East Asian	Founder	Victorian		
Southern	Four seasons	Viking		
hemisphere	Fragrance	Water		
Southwestern Asia	Lilies	Welcome		
Temperate Asia	Lovers	Willow		
	Memories	Winter		
	Senses	Woodland		
	Gravel	Xeriscape		

Inspection of online maps produced by BGCI-member botanic gardens revealed the presence of 36 elements and 12 facilities/services outlined in Table 11. The results show that leisure facilities, such as food outlets and gift shops, are an important garden constituency as are arboreta, herbaria, and tours-trails which constitute the core of botanic gardens.

Table 11. Recorded features and their percent distribution in BGCI-member botanic gardens

Thematic Elements	Elements	%
Living collection	Arboretum	45
	Conservatory/Conservation area	18
	Fauna	30
	Nursery	19
	Plant collection (ecological, geographical, taxonomic, thematic)	99
Research & Conservation	Herbarium	45
	Research center	2
	Seed Bank	35
Water Features	Fountain	9
	Lake	16
	Pond	31
	Wetland	9
Educational Experiences	Audio Guide	2
	Classroom/educational program/school program	15

	Exhibition	11
	Library	5
	Meeting point	4
	Museum	4
	Signage and Information board	3
	Tours - Trail	40
Social Experiences	Amphitheater	16
	Barbecue	5
	Gift shop	38
	Pavilion	25
	Restaurant - Café	54
	Wedding	10
Natural Experiences	Avenue	5
	Bike trail	9
	Children playground and trail	24
	Picnic	26
	Plant sale	4
	Treehouse	1
	Viewing platform	18
Cultural Experiences	Historic section	5
	Memorial	12
	Sculptures and monuments	13
Services/Facilities	Administrative building	21
	Drinking water	19
	First aid	8
	Information desk	29
	Parents room	7
	Parking and carpark	53
	Restroom	64
	Shelter	23
	Ticket counter	9
	Tram-scooter-shuttle bus	15
	Visitor education center	31
	Wheelchair access	25

C. Checklist of elements and facilities in botanic gardens

Detailed information was generated for each landscape element, and facility gathered from botanic gardens and includes information about the recommended size, layout and materials of the elements and other planning issues for each element (Appendix 1). An example is shown below:

Arboretum

Arboretum	Options
Elements and materials	- Softscape: grass, trees, flowers, shrubs - Hardscape: water feature, trail (gravel, soil or grass), rock boulders, benches, pergola
Size	- NA
Context	- Outdoor (Open space)
Circulation	- Wheelchair access - One level
Activities	- Walk - Jog - Sit - Rest - Take pictures - Observe the water feature
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	- Focal point
Keyword search	- Arboretum
Sources	- https://goo.gl/images/JRyb2j - https://goo.gl/images/xwBc5S - https://goo.gl/images/psaUMK - https://goo.gl/images/XrYTmA - https://goo.gl/images/hrKDkZ

D. Guidelines for elements and facilities

General botanic garden planning and design guidelines have been published in one study conducted in 2009. They address topics such as conservation botanic gardens and their design process. They were created based on the applicability of one case study. The guidelines presented here were developed based on map inspection of

existing 220 BGCI-member botanic gardens and analysis of 240 photos; the guidelines focus exclusively on planning decisions that can enhance the establishment of ancillary botanic gardens.

As such, the guidelines of each feature are as follows:

- Arboretum: It is an outdoor botanical collection composed of woody shrubs and trees. Distinct from a forest, a nursery or a park, it is an outdoor museum of trees, where trees and shrubs are cultivated for exhibition. It usually comprises a water feature, a trail that can be gravel, soil or grass and wide enough for wheelchair access. The arboretum offers the visitors a shelter and a seating area. In the arboretum, the visitors can compare mature plants and study the different varieties, and simultaneously enjoy the aesthetically pleasing place. It is accessible from the trail.
- Conservatory/Conservation area: It is a one-floor building with glass and metal roofing and walls, it is often used as a greenhouse. The conservatory houses potted plants, and contains benches and art installations such as monuments and sculptures. A path along the conservatory can be implemented with wooden handrail and metal railing. Visitors can learn about the plants.
- Fauna: Animals can be incorporated in botanic gardens, they are usually raised behind a metal or wooden fence. Visitors can observe and feed animals. The animal species vary in sizes, they can be as small as butterflies put in glasshouses or as big as a giraffe put behind a fence. This section could be part of the children trail.
- Nursery: It is a 100m^2 glass and steel structure with hanging plants, potted plants put on wooden or metal tables, the flooring is asphalt or gravel or paved. The path defined by the spacing of plants goes through the nursery and is wide enough to

accommodate wheelchairs. The plants are organized based on species. Visitors can take a look at the plants and buy them.

- Plant collection: It is a group of plants (trees, shrubs, grasses, flowers) grown for a defined purpose; they can be categorized as ecological, geographical, taxonomic or thematic. They are usually labeled. The collection can be indoor in a glasshouse or outdoor in open air.
- Herbarium: It is a collection of preserved plants displayed in glass tables with wooden base, metal lockers or envelopes are used to store the plants. The herbarium could be a floor in a building or a building by itself. Usually, the plants are stored for scientific research. The storage process is not always revealed to the visitors, it is usually in a separate floor open only to researchers and scientists.
- Research center: It is a building, preferably a green building where researchers conduct studies. It is accessible to the visitors and the lobby of the building is usually used for exhibitions featuring garden research and conservation studies.
- Seed Bank: It is a building or part of a building. It comprises wooden tables with glass displays to store seeds and preserve genetic diversity. The seeds are put in jars. The visitors are not always granted access to seed banks as they are purely educational venues.
- Fountain: Water feature made of stone, with shrubs and pavement around it. It is usually around 10-20m^2. The fountain is often used as a roundabout.
- Lake: Water feature with grass and trees around. The lake usually has a wooden deck that goes through it. The lake is fenced using metal or wooden fence and benches are installed around the lake to provide a seating place for visitors. The wetland is

often used as a focal point; therefore, a viewing platform is often constructed to overlook the lake.

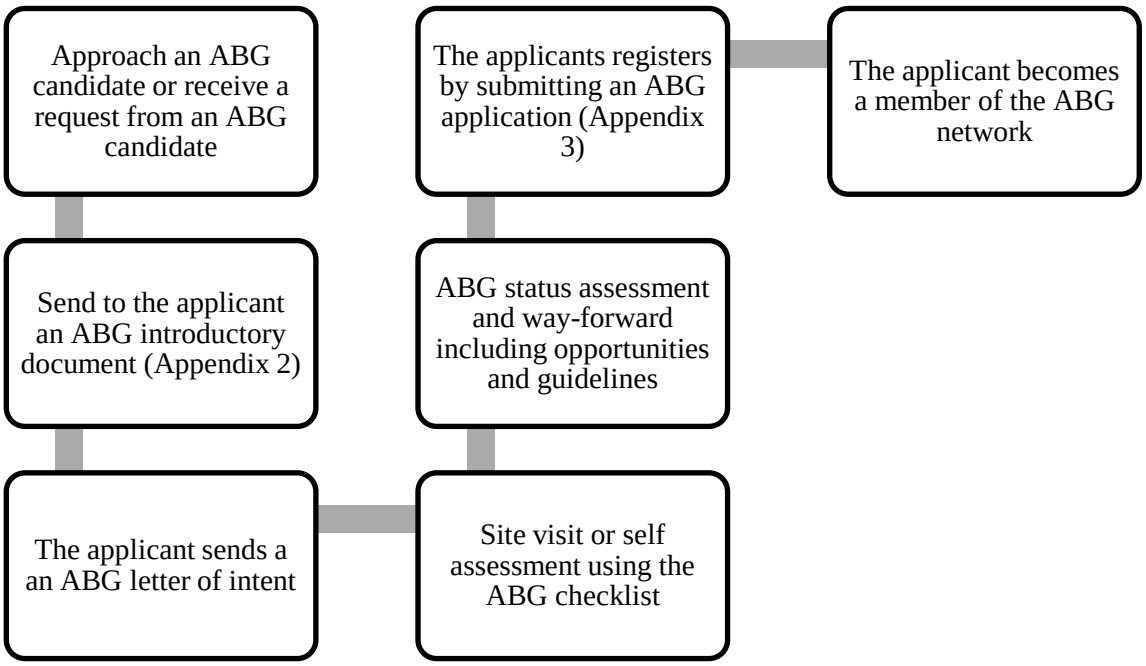
- Pond: Water feature with grass and trees around it. There is a paved or brick path passing next the pond. The pond acts as a focal point.
- Wetland: Water source with aquatic plants. The plants are usually labeled and large stone boulders are installed in the wetland to provide the visitors with the experience of walking on water. The wetland can act as a focal point, a corridor and a play area for the children.
- Audio guide: It is usually a smartphone application that has to be downloaded on the visitor's mobile, however some gardens provide the visitors with mobiles and earphones at the visitor education center. The visitors refer to the number or the barcode engraved on the plant label to listen to the corresponding audio.
- Classroom: It is a $25m^2$ concrete structure or a glasshouse or a metal-based canopy tent that houses tables and chairs.
- Exhibition: It is a display of a selection of items. Exhibitions usually occur in a glass or PVC structure. It is common in botanic gardens to have the trail pass by the exhibition area.
- Trail: The surfacing of primary trails should be accessible to a wheelchair. Design trails as loops, so the visitor always begins and ends in the same place. The trail is usually between 1.5 and 2m and the material ranges from pavement, to asphalt, to soil and fine gravel.

There are foundational facilities that are repeatedly found and necessary for the operation of botanic gardens, these are:

- Administrative building: A building which accommodates gardens services, including offices for garden staff.
- Drinking water: Stone monument or steel structure providing potable water. It can be accessible from the trail or can be part of the trail.
- Entry gate: Paved area with steel gate and shelter. It includes a ticket counter kiosk.
- First aid: Collection of supplies and equipment, used to give urgent medical treatment.
- Information desk: Booth where users can ask questions about garden elements and facilities.
- Parents room: Changing room facilities.
- Parking and carpark: Paved area allocated as private garden parking with a wooden or paved pedestrian sidewalk. It can also be a carpark on the road leading to the garden.
- Restroom: Concrete structure, wooden or metal ceiling, 20 m^2 (2-5 bathrooms), independent entity, wheelchair accessible, accessible from the trail.
- Shelter: It is a steel or concrete canopy tent with a brick roof; it contains steel benches, tables, and chairs. Accessible from the trail.
- Ticket counter: Concrete or wooden booth where visitors can buy garden tickets before entering the garden.
- Tram-scooter-shuttle bus: Free shuttle or tram service to/from a specific location and the Botanic Garden (ex: Denver botanic garden).
- Wheelchair access: The garden has to meet ADA Standards for Accessible Design; therefore, a paved or asphalt or wooden path with stone to delineate the road and metal or steel net as a railing with signage. The path is usually 1.5 m width.

E. Guideline implementation tool

Strategy for ABG implementation



F. Thematic elements of botanic gardens: Content analysis and generation of themes

The elements of the botanic gardens were grouped under seven themes and organized according to the four missions of botanic gardens (conservation, education, research, and recreation) with each element serving more than one mission (table 13).

Table 12. Distribution of elements according to themes and possible botanic garden mission they can serve

Thematic Elements	Elements	Conservation	Education	Research	Recreation
Living Collection	Arboretum	x	x	x	x
	Conservatory/Conservation area	x	x	x	
	Fauna	x	x	x	x
	Nursery	x	x	x	
	Plant collection (ecological, geographical, taxonomic, thematic)	x	x	x	x
	Herbarium		x	x	

Research & Conservation	Research center		x	x	
	Seed Bank	x	x	x	
Water Features	Fountain				x
	Lake		x		x
	Pond		x		x
	Wetland		x		x
Educational Experiences	Audio Guide		x		
	Classroom/educational program/school program		x		
	Exhibition		x		x
	Library		x		
	Meeting point		x		x
	Museum		x		x
	Signage and Information board		x		x
	Tours - Trail		x		x
Social Experiences	Amphitheater		x		x
	Barbecue				x
	Gift shop				x
	Pavilion		x		x
	Restaurant - Café				x
	Wedding				x
Natural Experiences	Avenue		x		x
	Bike trail				x
	Children playground and trail		x		x
	Picnic				x
	Plant sale				x
	Treehouse		x		x
	Viewing platform		x		x
Cultural Experiences	Memorial		x		x
	Sculptures and monuments		x		x
	Historic section		x		x

G. Case studies

Lebanon is on the Eastern side of the Mediterranean basin. It is a predominantly Mountainous country, possessing five geomorphological zones, a narrow coastline, two mountain chains running parallel to the Mediterranean coast, a high plateau and a plain, the Bekaa valley. The country contains typical Mediterranean plant communities, and is part of the Mediterranean Basin Global Biodiversity Hotspot, with

estimated 2612 vascular plant taxa, of which 108 are endemic to Lebanon (Tohmé & Tohmé, 2014; Talhouk et al., 2014; MOE/UNEP/GEF, 2016).

Figure 8. Geographic location of the case studies

Case-study 1: 'Adonis Valley' estate

'Adonis Valley' is situated northeast of Lebanon's capital Beirut, along the banks of Adonis river, in a village called Fatri in Byblos district. It is located at an elevation of 500m above sea level. The table of assessment or checklist (table 14) derived from the study was used to analyze the Adonis Valley estate and provide recommendation for the establishment of an ABG.

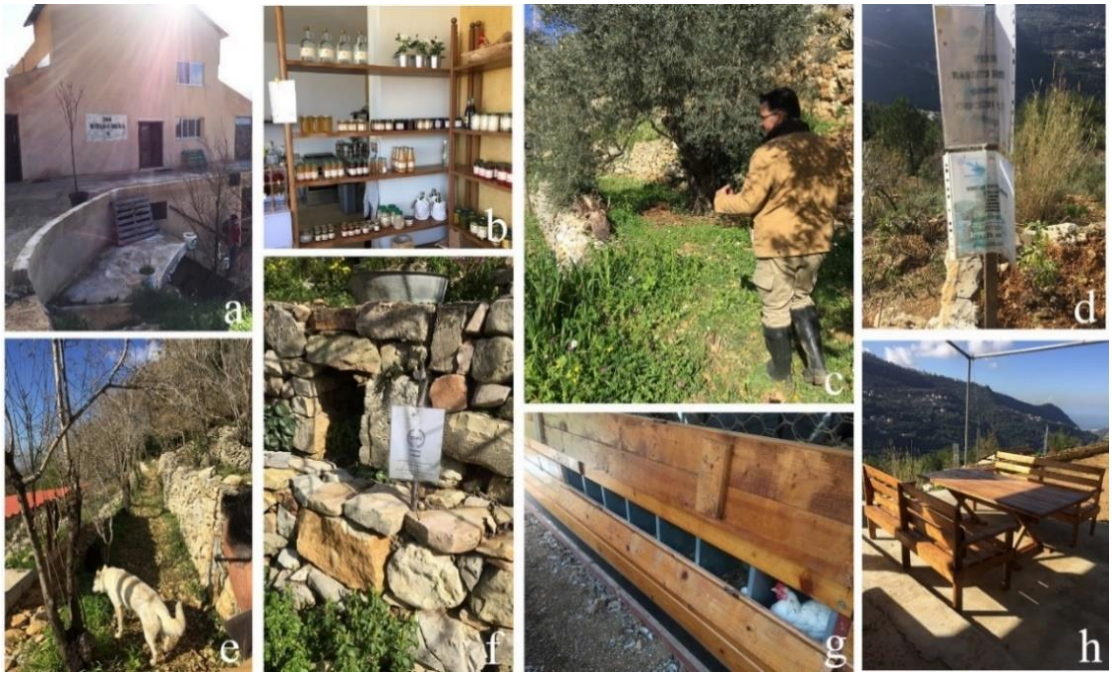


Figure 9. Some representative pictures of Adonis valley a) administrative building and factory, b) Gift shop, c) Trail, d) Signages, e) Terraces, f) Grape mill, g) Chicken house, h) Shelter and benches.

The developed checklist (table 14) constituted an easy tool for site analysis and for developing recommendations and focusing on opportunities that will enrich the site as an ABG.

Table 13. Table of assessment (checklist) for Adonis Valley

Thematic Elements	Elements	Present on site	Not present	Action Items
Living Collection	**Arboretum**		x	NA
	Conservatory/Conservation area		x	Aged olive trees and native terrace habitat
	Fauna		Sheep, chicken for production	Children farm
	Nursery		x	NA
	Plant collection (ecological, geographical, taxonomic, thematic)	Stone terraces Mediterranean native and traditional fruit tree varieties		Educational
Research & Conservation	**Herbarium**		x	NA
	Research center		x	NA
	Seed Bank		x	NA
Water Features	**Fountain**		x	

	Lake		x	
	Pond		x	Water available onsite, build a small pond
	Wetland		x	
Educational Experiences	**Audio Guide**		x	
	Classroom/educational program/school program	Educational programs for people of all ages. Classes range from outdoor organic cooking lesson, to children hands-on classes		Build a classroom next to factory building.
	Exhibition		x	Hold exhibitions on large terrace
	Library		x	
	Meeting point		x	Formalize meeting point next to historic olive tree
	Museum		x	Create a traditional agricultural tools museum
	Signage and Information board	x		Started labeling trees, can add signage narrating ABG history
	Tours - Trail	The trail was developed by the owner, it goes through the whole ABG		
Social Experiences	**Amphitheater**		ABG Area too small	
	Barbecue	There is one wood grill		Could be used for live cooking
	Gift shop	The gift shop sells juices, jams, tomatoes derives and pickles		
	Pavilion		ABG Area too small	
	Restaurant - Café	The restaurant offers healthy organic food		
	Wedding		ABG Area too small	

Natural Experiences	**Tree-lined avenue**		ABG Area too small	
	Bike trail		Steep terrain	
	Children playground and trail		x	Natural playground and children trail
	Picnic		ABG Area too small	
	Plant sale		x	Sell seeds and seedlings of herbs
	Treehouse		ABG Area too small	
	Viewing platform		x	Location of ABG has a strategic view a platform can be considered
Cultural Experiences	**Historic section**	There are ruins of old mill and grape press		
	Memorial		x	The story of ABG revolves around the grandfather of the owner and a memorial can be considered
	Sculptures and monuments		x	
Facilities	**Administrative building**	The administrative building is also assigned as facility for food production		
	Drinking water		x	Provide clean drinking water through traditional jar 'breek'
	First aid		x	Assign location for first aid kit and emergency numbers
	Information desk		x	Produce informative flyers at reception
	Parents room		There is no changing room facility	Consider a small outdoor private space parent and infant
	Parking and carpark	There is a parking		

		directly at the entrance of the ABG		
	Restroom	There is one restroom		
	Shelter and benches	The ABG possesses a shelter that can accommodate around 20 persons		Use shelter as classroom facility
	Ticket counter		Entrance is free, no ticket counter	
	Tram-scooter-shuttle bus		There are no tram or shuttle bus	
	Visitor education center		There is no visitor education center	The administrative building can be used as visitor education center
	Wheelchair access		No wheelchair access	Develop tour specifically catering for wheelchair access

Case-study 2: Sursock Palace "The Gardens"

Sursock Palace "The Gardens" is situated in Sursock streets at the heart of Achrafieh in Lebanon's capital Beirut. The table of assessment or checklist (Table 15) derived from the study was used to analyze the private garden and provide recommendation for the establishment of an ABG.

Figure 10. Some representative pictures of Sursock Palace "The Gardens"
a) Historic trees, b) Edible garden, c) Nursery, d) Trail, e) Wedding venue and plaza, f) Fountain and sculpture

Table 14. Table of assessment (checklist) for Sursock Palace "The Gardens"

Thematic Elements	Elements	Present on site	Not present	Action Items
Living Collection	**Conservatory/Conservation area**		x	
	Arboretum		x	
	Fauna		Tortoise living on premises	Children animal encounter
	Plant collection (ecological, geographical, taxonomic, thematic)	Garden trees of historic Beirut homes		Educational opportunities
	Nursery	There is a tree nursery which supplies the needs of the garden		Educational opportunities
Research & Conservation	**Herbarium**		x	
	Research center		x	
	Seed Bank		x	
Water Features	**Fountain**	x		
	Lake		x	

	Pond		x	
	Wetland		x	
Educational Experiences	**Audio Guide**		x	
	Classroom/educational program/school program	Plant tours for schools and university tours by appointment. The candidate offers classes in ceramic art		
	Exhibition	The garden has a large area for exhibition (indoor and outdoor)		
	Library		x	
	Meeting point		x	The large plaza at the entrance can serve as meeting point
	Museum	The candidate has an archive of old photos of Beirut and the Sursock residence, open to the visitors		
	Signage and Information board		x	Can label trees, and add signage narrating ABG
	Tours - Trail		x	Can incorporate a trail. The trail could be defined paved path that goes through the garden
Social Experiences	**Amphitheater**		x	
	Barbecue		Private residence not open to barbeque by public	
	Gift shop		x	Can add a gift shop of artisanal gadgets especially that the garden dates from 1860
	Pavilion		x	
	Restaurant - Café		x	Can add a kiosk which opens when the doors are open for tours
	Wedding	The garden is open for weddings		
Natural Experiences	**Tree-lined avenue**		Space too small	

	Bike trail		Space too small	
	Children playground and trail			Can incorporate a children trail or tour
	Picnic		Private residence	
	Plant sale		Revenue generated by renting venue for weddings and events	
	Treehouse		x	
	Viewing platform		x	
Cultural Experiences	**Historic section**		x	Can add a historic section narrating the history of the estate and the garden's timeline
	Memorial		x	The story of ABG revokes the history of Sursock family, therefore a memorial could be considered
	Sculptures and monuments	There are sculptures and monuments dating from 1860		Need to recruit expert to curate collection
Facilities	**Administrative building**	Small offices used for wedding rentals		
	Drinking water		x	
	First aid		x	Should have facility for first aid
	Information desk		x	
	Parents room		x	
	Parking and carpark	There is a parking directly at the entrance of the ABG		
	Restroom	There are 2 restrooms		
	Shelter and benches		x	
	Ticket counter		x	
	Tram-scooter-shuttle bus		x	
	Visitor education center		No need because visitations are only by appointment	

	Wheelchair access	No wheelchair access to some areas in the garden	It is possible to incorporate wheelchair access in these areas

Case-study 3: Brummana High School

Brummana High School is situated in Brummana in Mount Lebanon, 10 kilometers east of Beirut. The school has a very spacious campus of 16 acres. The table of assessment or checklist (table 16) derived from the study was used to analyze the campus and provide recommendation for the establishment of an ABG.

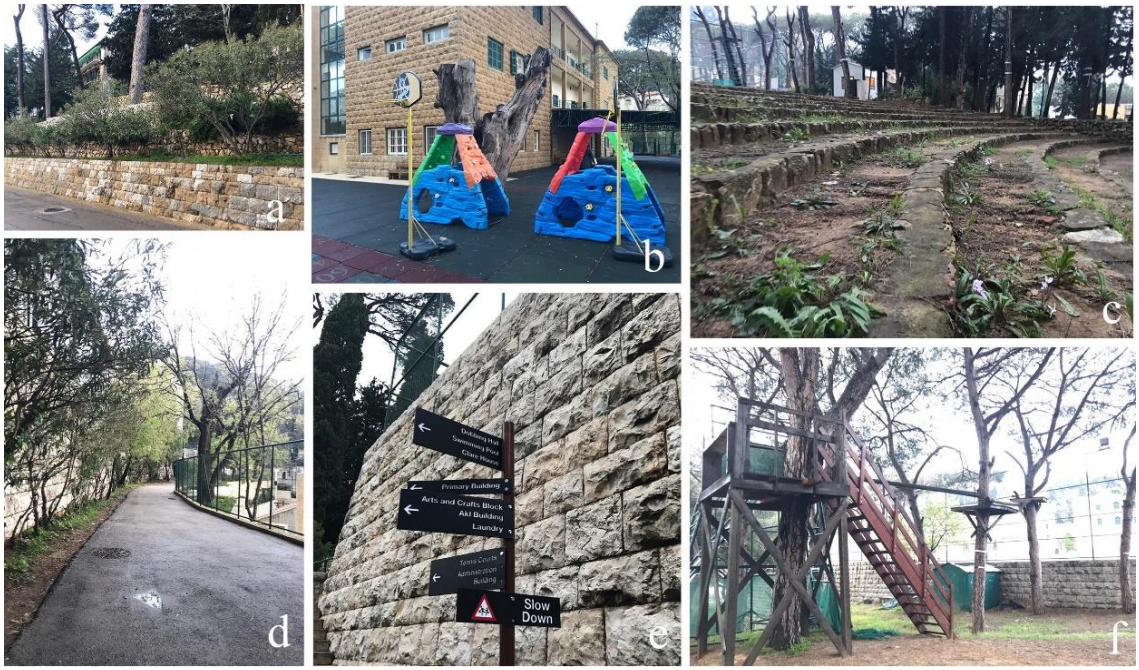


Figure 11. Some representative pictures of Brummana High School Campus a) Mediterranean terraces b) Children playground, c) Amphitheater, d) Trail, e) Signage f) Treehouse

Table 15. Table of assessment (checklist) for Brummana High School Campus

Thematic Elements	Elements	Present on site	Not present	Action Items
Living Collection	**Arboretum**		x	There is a potential for an arboretum for Pine trees

	Conservatory/Conservation area		x	There is a potential spot in the middle campus, there are terraces housing old Cupressus trees
	Fauna		Birds & cats	Children animal encounter
	Nursery	There is a tree nursery and a greenhouse which supplies the needs of the garden		Educational opportunities
	Plant collection (ecological, geographical, taxonomic, thematic)	Trees of historic Lebanese gardens		Educational opportunities
Research & Conservation	**Herbarium**		x	
	Research center		x	
	Seed Bank		x	
Water Features	**Fountain**		x	For the safety of the children
	Lake		x	
	Pond		x	
	Wetland		x	
Educational Experiences	**Audio Guide**		x	
	Classroom/educational program/school program	x		There are classrooms which can be potentially used by ABG
	Exhibition	The garden has a large plaza that can be used for exhibition (indoor and outdoor)		
	Library	x		
	Meeting point		x	The large plaza at the entrance can serve as meeting point
	Museum	The candidate has an archive,		Further info is required
	Signage and Information board		x	Can label trees, and add signage narrating ABG
	Tours - Trail	There is a group that tours around Brummana area. It includes the school premises as part of their tour.		Can incorporate a trail. The trail could be defined paved path that goes through the garden
	Amphitheater	x		

Social Experiences	**Barbecue**		School not open to such activities	
	Gift shop	The school has a bookshop		Can add botanical artisanal gadgets
	Pavilion		x	
	Restaurant - Café	The school has a cafeteria open to students		This cafeteria can be used by the ABG
	Wedding	x		
Natural Experiences	**Tree-lined avenue**	At the entrance		
	Bike trail		x	There is a potential for a partial bike trail
	Children playground and trail	x		Can incorporate a children trail
	Picnic		Private school	
	Plant sale		x	Can add it
	Treehouse	x		
	Viewing platform	x		
Cultural Experiences	**Historic section**		x	Can add a historic section narrating the history of the estate and the garden's timeline
	Memorial	Memorial of the founder		
	Sculptures and monuments	There is a monument in the memory of the founder		
Facilities	**Administrative building**	x		
	Drinking water	x		
	First aid	x		
	Information desk	x		Teach the people responsible
	Parents room	x		
	Parking and carpark	x		
	Restroom	x		
	Shelter and benches	x		
	Ticket counter		x	It is school but the ticket counter has a potential location
	Tram-scooter-shuttle bus	x		Maybe the school buses can be used for transportation
	Visitor education center		x	

	Wheelchair access	No wheelchair access to some areas in the garden	It is possible to incorporate wheelchair access in these areas

CHAPTER V

DISCUSSION

The rapid expansion of cities has led to ‘bubblewrap generations’ that have ‘nature-deficit’ childhoods and are ‘blind’ to the natural world (Louv, 2008; Malone, 2007; Wanderssee & Schussler, 1999). For a ‘plant blind’ person, vegetation is merely a green, blurry backdrop for human-made objects in urban neighborhoods. Furthermore, animals are more charismatic than plants and people concerned with conservation are sensitized to threats faced by animals but do not ‘see’ plants as the basis of animal habitats and life on earth (Abbott, 1998). “Botanical education, plant mentorship, and direct experience” to make “plants become salient, meaningful, and valued is one cure for bubble wrap and plant blindness” (Wandersee, Clary, & Guzman, 2006).

Botanic gardens are an important venue for city residents linking them with plants through education, exploration, and discovery (Sanders, 2010). With over 2,900 in the world, botanic gardens safeguard plant species in living collections and host hundreds of millions of visitors per year providing them with the opportunity to ‘stay in touch’ with nature, promoting a balanced relationship with biodiversity, and offering an nature refuge away from urban noise, air pollution, and heat (BGCI, 2019c; Smith, 1990).

However, our findings show that the global impact of botanic gardens is limited by their current geographic distribution with only seven countries housing half the recorded botanical institutions. This result supports findings by O'Donnell and Sharrock (2017) and Antonelli et al. (2015) who indicated that the number of botanic

gardens is relatively low in regions where plant diversity is high, namely the tropical regions of Asia (including Australasia), South America, and Africa. Africa houses 188 botanical institutions or 5% of the total recorded botanical institutions while biodiversity in the continent constitutes around a quarter of the global biodiversity (UNEP-WCMC, 2016). Talhouk et al. (2014) reported that the number of botanic gardens in the Arab world is the lowest per area.

A 470-year overview shows that the establishment of botanic gardens flourished during the period between 1850 and 1995 (Fig. 6). Contrary to what would be expected, the rate of establishment of botanic gardens is increasing though botanic gardens are struggling in the absence of financial and technical support (Heywood & Iriondo, 2003; Wyse Jackson, 1999); especially that the costs of creating and managing a botanic garden are higher than any other green space because they include costs related to visitors, plant labels, other infrastructures, and the need for trained personnel such as gardeners, botanists and tour guides to develop, manage, and curate plant collections (Hohn, 2008; Trull, Penn, & Hu, 2018). Our findings show that half of the botanic gardens around the world have sizes below 25 hectares, and this is due to the difficulty in appropriating land in cities to establish botanic gardens and dedicate financial resources to operate them as it is considered to be an unjustifiably expensive initiative considering the high rate of urbanization which leads to a substantial rise in land values (Talhouk et al., 2014). For example, in 2006 parts of the Bermuda Botanical Gardens estate were appropriated to construct a new hospital (Benfield, 2013). Davis (1999) urged researchers to look for ‘new ways of doing things that break from existing destructive patterns, which reconnect us to each other and with the earth.’

To address the issue of space and financial limitations to the establishment of botanic gardens, Talhouk et al. (2014) proposed a new category of botanic gardens they termed Ancillary Botanic Gardens (ABGs). The authors explain that ABGs are secondary on a spatial level in that they are established on peripheral areas of sites already assigned a primary purpose. These sites are managed and accessible to the public but are practically restricted and protected through specific legislation and policies. Once a peripheral land opportunity has been identified, the objectives guiding the planning, design, and establishment of an ABG include no or minimal interference with the primary function of the site. ABGs are also conceived by the authors as socially inclusive to address the problem of perception that botanic gardens are exclusive and elite institutions (Powledge, 2011). An example of a locally driven botanical institution has been reported in Palestine where concerned citizens transformed a neglected 1.2 hectares area into a botanic garden by depending on local donations and volunteer efforts to establish the garden (Qumsiyeh et al., 2017). The need for local models of botanic gardens was also proposed through the creation of municipal botanic gardens that can serve as urban institutions which offer residents an easy opportunity to understand the importance of preserving natural resources. Since they are nearby, they can attract numerous visitors, and their structure is not very costly since they are tiny urban remnants (Ellof, 1987).

With respect to ABGs, the proposed informal structure is based on non-prescriptive local agendas and the engagement of all those interested in promoting the link between plants and people including taxonomically illiterate community members who rely on local nomenclature to sustain the transfer of traditional and ethnobotanical knowledge.

The need for additional botanic gardens and a broader constituency involvement is well reported, however questions regarding what constitutes physically a botanic garden and where to establish ABGs and is not clear. The purpose of this study is to address these questions by benchmarking against BGCI-member botanic gardens.

Concerning space, our findings revealed that botanic gardens as institutions are diverse in terms of ownership which can be public or private and size which may range from 1 hectare to thousands of hectares (Fig. 5, Table 8). Accordingly, seeking potential sites for ABG establishment is adaptable to various communities including the private sector, public sector, civil society, educational communities, urban communities, and rural communities. All stakeholders, such as universities, municipalities, or other public or private institutions can potentially contribute to ABGs using their available resources.

Living collections are the easiest way of ex-situ conservation in botanic gardens. Without it, most botanic gardens would not have existed. It has been a long tradition that botanic gardens have been judged by the number of individual representatives of different species held in the garden (Maunder, 1994). The living plant collections are the face of the botanic garden. Bigger is better and more is merrier have been concepts that have accelerated the expansion of living plant collections (Robertson, 1996). Maunder (1994) argues that botanical gardens will be judged by the number of viable species and habitats surviving as a result of their intervention, and by their contribution to economic and social development but not by the number of the species maintained as 'botanical living dead'. Too often, '…it seems that the collections are built up first and then a justification for their existence is sorted out afterward' (Rae 1995). Even where original collection strategies were well defined, over time the

purpose and meaning of many collections has become uncertain (Oikawa & Kendle, 1999). Living collections are becoming less and less important for research and conservation. However, we found an equally broad scope of possibilities that can include any conceived theme that may be relevant or attractive locally. Many gardens feature plant collections of geographic origins, but plants are also displayed under a large array of themes that seem to have been selected to attract local interests and contribute to local relevance. Thematic topics to plant collections are important because they promote an informal learning format characterized by a self-directed style of information sharing, activities, and storytelling which is vital in helping build a link between people and their local natures (Sanger, 1997). The living collection's role as the main method for maintaining plant diversity has been largely superseded by the development of new technology such as seed banks. It is now possible to conceive that botanic gardens could fulfill at least their scientific mission with vastly reduced collections (Oikawa & Kendle, 1999). If living collections, or gardens, are to continue to play a role, it will be important to clarify their purpose as related to their own institution's mission.

With respect to physical infrastructure, our study shows that there are 36 recurring elements in botanic gardens, many of which provide recreational and educational services to visitors. Elements that include plant conservation and research are present as well but at a lower rate. These findings are consistent with other studies that consider botanic gardens as providers of education and recreation (Dodd & Jones 2011; Kohlleppel, Bradley, & Jacob, 2002). Botanic gardens showcase both nature and leisure at the same time (Kohllepel et al., 2002). The educational amenities can range from academic courses and workshops for schools and universities students, to exhibitions and

multi-sensory engagement with plants such as tours, trails and various signages (Dodd & Jones, 2011). The recreational elements offer the visitors various experiences such as social experiences including restaurants and weddings, natural experiences such as picnic areas or natural playground, cultural experiences such as sculptures or monuments installed in the garden, or by walking through historic sections in the garden. Our results benefit groups and institutions who intend to establish ABGs because they can understand the value of recreational elements which are abundant in botanic gardens and which have been developed not only to attract visitors but also to address financial problems (Powledge, 2011). For example, some botanical gardens have added a gift shop and introduced new marketing techniques to the garden to attract visitors (Powledge, 2011). Aynur (2014) who analyzed the purpose of visiting the botanic gardens and the factors affecting the nature of the visit, concluded that 44% of visitors visit the botanic garden to enjoy the aesthetically pleasing landscape and 34% were there for picnics and entertainment.

Our findings also shed light on the fact that ‘not all gardens have the resources (monetary or staff) to undertake rigorous scientific research or conservation programs and can instead affiliate with universities, independent researchers, NGO's, industry, government agencies and through local and national networks (Krishnan, 2016).

The list of 36 elements (Table 11), in addition to essential facilities, was derived from a study of hundreds of botanic gardens throughout the world and helped develop guidelines that are not readily available in the literature (Houston, 2009). The checklist produced in this study proved to be a useful tool helped in assessing the site and in providing opportunities for guiding the establishment of ABGs.

Case Study 1

Adonis Valley estate is owned by an organic farmer and entrepreneur who decided to rehabilitate the land and terraces in memory of his grandfather who owned and farmed the land. By establishing Adonis Valley, the farmer wanted to reconstruct stories and traditions and rehabilitate the old Mediterranean terraces that still support aged olive trees. The estate is 3.5 ha, and he is interested in allowing native flora, that is typically associated with olive terraces, to grow. His intent is to label species to offer botanical education opportunities for visitors. By transforming the site into an ABG, he hopes to promote knowledge about local flora while maintaining the site's primary function which is the production of certified organic authentic Lebanese and Mediterranean juices, jams, and preserves. For this purpose, the owner has rehabilitated old stone terraces and modified cultivation practices to allow the growth of local flora. Furthermore, he is planting local fruit tree varieties, aromatic and medicinal plants, and he is raising farm animals namely sheep and chicken the traditional way to revive the Lebanese food heritage. The estate also houses an old grape mill. The checklist allowed the production of the following report for the ABG applicant.

- Living collections: The ABG houses 44 plant species ranging from herbs to shrubs to trees. These plant species were identified by experts at the American University of Beirut and are used in the educational tours that are regularly organized by the owner. Farm animals on site namely free-range sheep and chicken can be developed into child-friendly activity. The ABG does not have a conservation area, nor a nursery, nor an arboretum. However, the historic terraces that house aged olive trees (fig. 12), and a large number of native bulbs and annuals can be transformed into a small conservation area for native Mediterranean habitat.

	**Comments:** Aged olive trees and terrace can serve as conservation area.
	Mediterranean native plants and traditional trees can constitute the plant collection.

Figure 12. Living collections in Adonis Valley estate

- Research and Conservation: The ABG does not have any research and conservation elements such as herbarium, seed bank and research center.

- Water features: The ABG does not have any water feature, but a local water source is available, and a small pond with aquatic plants can be built (fig. 13)

Comments:

Water available on site can be developed into a water feature

Figure 13. Water feature in Adonis Valley estate

- Educational experiences: The ABG offers outdoor educational programs, but there are no indoor classrooms. A classroom could be built next to the production building or the existing shelter, and existing benches could be used for this purpose (fig. 14). The ABG has no exhibition space, but there is a large terrace which can serve this purpose when the need arises. The ABG does not have a well-defined meeting point although people typically meet at the historic olive trees; this can be formalized. The ABG has no museum, but the owner could establish a traditional agricultural tool museum which evokes the memory of his late grandfather. All trees and herbaceous

plants have been labeled in collaboration with experts at the American University of Beirut. Additional signage on traditional terraces and native plants could be introduced to narrate the identity of the ABG. The ABG offers a trail that goes through the whole estate. The trail can be further developed into different experiences; a children trail, a wild edibles trail, food production tour…

	**Comments:** A classroom could be built next to the production building
	The terrace assigned for seating can be turned into a large exhibition area when the need arises

	The meeting point next to historic olive tree could be formalized
	A traditional agricultural tool museum could be established to revoke the memory of Toufic

	Additional signage could be introduced to narrate the identity of ABG.
	The trail could be further developed into different experiences (wild edible trail, food production tour)

Figure 14. Educational experiences in Adonis Valley estate

- Social experiences: The ABG offers no potentials for an amphitheater, a pavilion or a wedding venue because the area is small. The ABG includes a barbecue area which can turn into a live cooking outdoor class and a restaurant which can accommodate visitors. The ABG has a gift shop which sells organic food products. Additional items such as Lebanese handmade craft or botanic garden gadgets could be added to diversify products.

	Additional items such as Lebanese handmade crafts and botanic gadgets could be added to the existing gift shop.
	The restaurant offers healthy organic food

Figure 15. Social experiences in Adonis Valley estate

- Natural experiences: The site does not include natural experiences and has no potential for a tree-lined avenue or a picnic area or a treehouse since the area is small, nor a bike trail because the site falls on steep terrain. However, the candidate could incorporate some natural experiences elements such as children natural playground or a viewing platform especially that the site has a strategic location on a hill overlooking the mountains. He could also sell seeds or seedlings of native herbs.

	There are plenty of native plants on site, the candidate could offer a plant sale for native seeds

	The site has a strategic location on a hill, a viewing platform could be incorporated

Figure 16. Natural experiences in Adonis Valley estate

- Cultural experiences: The candidate established this farm in the memory of his late grandfather; therefore, a memorial could be considered. In addition, he could further emphasize on the old grape mill.

	- A memorial could be considered to evoke the memory of the owner's grandfather. - A historic section could be established emphasizing on the ruins of old mill and grape press.

Figure 17. Cultural experiences at Adonis Valley estate

- Facilities: the candidate has an administrative building and offers to the visitors the following facilities: parking, restroom, shelter. However, there are some essential facilities that need to be added such as first aid, public telephone, wheelchair access, and a visitor education center and an information center that can be merged with the administrative building/production.

	Drinking water (Breek), First aid, wheelchair access need to be added. A visitor education center, and an information center can be merged with the administrative building

Figure 18. Facilities in Adonis Valley estate

Case Study 2

Sursock Palace “The Gardens” is is a private home and garden in Beirut built in 1860 by Moussa Sursock. Today the estate is amongst the largest Beirut private home that survived intact. The private garden is open for weddings and exhibitions.

- Living collections: The ABG houses 40 plant species ranging from shrubs to trees which were identified by experts at the American University of Beirut. These plant species which are used to beautify the garden, constitute typical trees of old Beiruti houses. There are tortoises in the garden. The owner may consider adding bird feeders and other interventions to develop the garden into a wildlife-friendly environment and use it to develop child-friendly activities. The ABG does not have a conservation area, or an arboretum. However, it comprises a nursery supplying the needs of the garden. This nursery can be part of the educational gardening programs.

	The plant collection comprises garden trees of historic Beirut homes

	The nursery can be part of the educational gardening programs

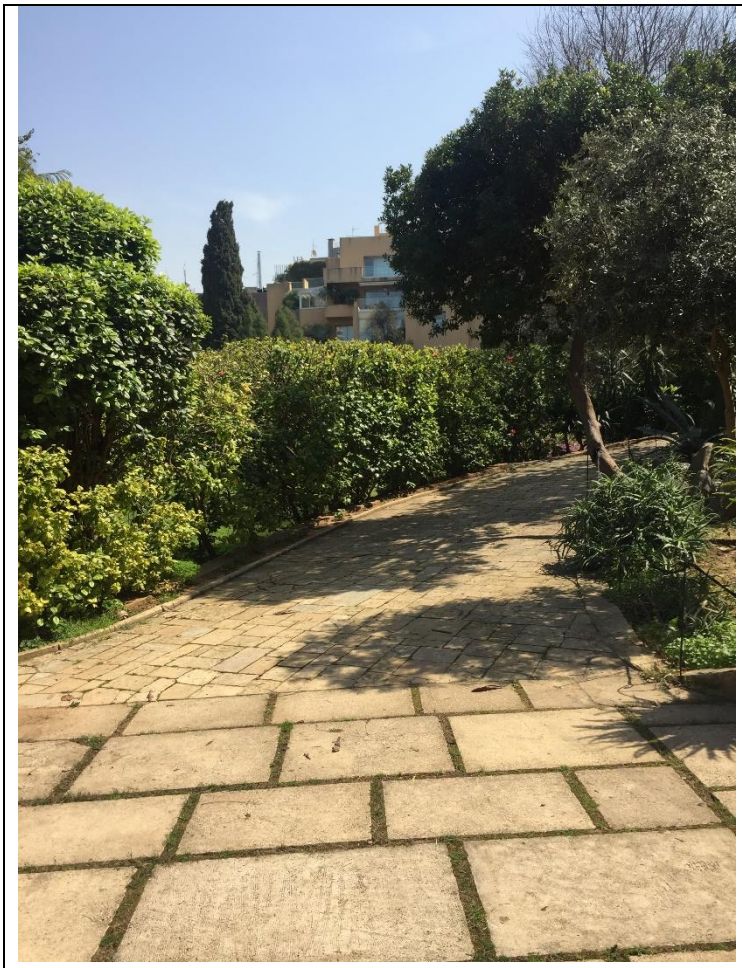
Figure 19. Plant collection in Sursock Palace

- Research and Conservation: The ABG does not have any of the following research and conservation elements: herbarium, seed bank, research center.
- Water features: The ABG has a fountain which could house aquatic plants.

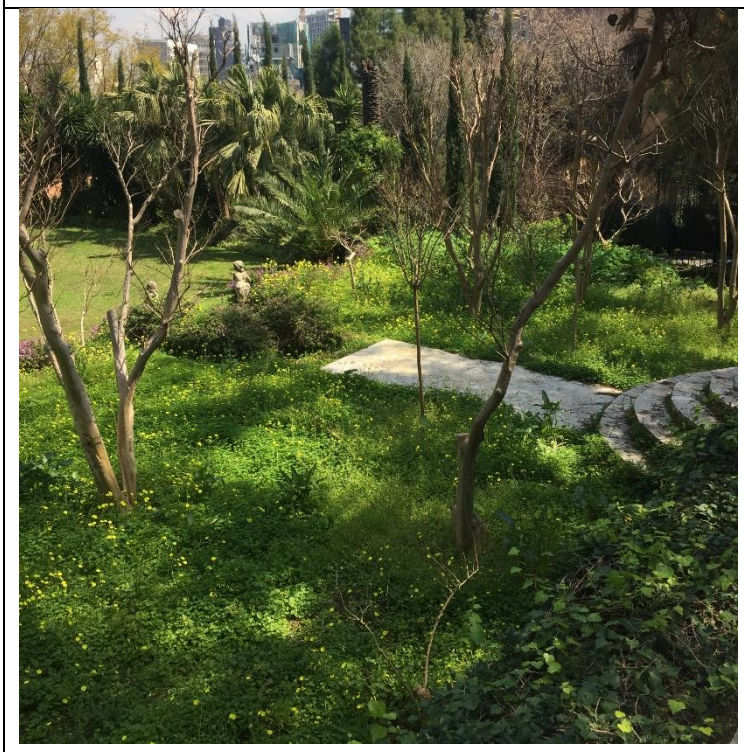
	The fountain could house aquatic plants

Figure 20. Water feature in Sursock Palace

- Educational experiences: The candidate offers the possibility for plant tours by appointment for schools and universities. The tours are normally guided by the school or university instructor. The candidate offers classes in ceramic art by appointment. The garden has a large area for exhibition (indoor and outdoor), plant or art exhibitions can be held in the garden. The large plaza at the entrance can serve as a meeting point for the tour. The candidate has an archive of old photos of Beirut and Sursock residence. Maybe this feature can be incorporated into the trail too. The trail is already defined and incorporated in the garden; it goes through the whole estate. The trail can be further developed into different experiences; a 20th-century trail…The candidate can label trees, and add signage narrating the history of the ABG.

	Plant tours and ceramic art classes are offered by appointment

	Plant or art exhibitions can be held in the garden
	The large plaza at the entrance can serve as a meeting point for the tours

	The available archive of old photos of Beirut and Sursock could be open to visitors as a museum feature.
	Tree labels and signages narrating the history of ABG could be incorporated.

- Social experiences: The ABG offers no potentials for an amphitheater, a pavilion, or a barbecue since it is a private garden and allows the public in only by appointment or when there is an occasion. The candidate has the potential to add a gift shop that sells artisanal or botanical gadgets or ceramics prepared by the owner; this gift shop could be established next to the entrance gate. The candidate could add a kiosk for snacks which opens when the garden is open to visitors.

	Potential to add a gift shop that sells artisanal, or ceramic gadgets prepared by the owner.

- Natural experiences: The site does not include natural experiences and has no potential for a tree-lined avenue since the garden has mature trees. There is no potential for a picnic area or a treehouse or a bike trail since the garden is a private estate.

However, the candidate could incorporate some natural experiences elements such as children natural playground.

- Cultural experiences: The garden is owned by Sursock family, one of the renowned families in Lebanon, therefore the ABG can serve as a venue to evoke the history of Sursock family along with the history of Beirut; a memorial could be considered. There are sculptures and monuments dating from 1860 which are not curated; there is a need to recruit experts to curate the collection. The candidate can add a historic section narrating the history of the estate and the garden.

	The ABG can serve as venue to evoke history of Sursock family. A memorial could be considered

- Facilities: The candidate has an administrative building and offers to the visitors the following facilities: parking, restroom, shelter. However, there are some essential facilities that need to be added such as first aid, wheelchair access. However, a visitor education center and an information center are not essential, especially that the garden is open to visitors by appointment only.

Case Study 3

Brummana High School is situated in Mount Lebanon, 10 kilometers east of Beirut. It is a private school founded in 1873. The school campus is 16 acres large with 16 buildings situated on a wooded hillside with panoramic views, fine old stone buildings in the traditional Lebanese style of architecture.

- Living collections: The ABG houses a small number of plant species ranging from shrubs to trees. There is a need to add more species to the plant collection. The number of trees and shrubs is high, but the diversity is low. Regarding animals, there are birds and cats on campus. The ABG may consider adding bird feeders and other interventions to develop the garden into a wildlife-friendly environment and use it to develop child-friendly activities. The ABG does not have any of the following living collection elements such as conservation area, nursery, and arboretum. However, the historic pine and cypress trees that grow on terraces can be transformed into a small Mediterranean woodland conservation area. The ABG has a nursery as well, which might be used for educational purposes especially the production of forest seedlings considering the context of the school.

	The historic pine and cypress trees can be transformed into a small Mediterranean woodland conservation area.
	The diversity of plant collection is low. The ABG may consider bird feeder to develop a children wildlife-friendly environment.

- Research and Conservation: The ABG does not have any of the following research and conservation elements such as herbarium, research center and seed bank.
- Water features: The ABG has a gated swimming pool but does not have any other water feature since it requires supervision, but a local water source “Ein Al Salam” is available, this could be further investigated, and a small pond might be useful to introduce aquatic plants.
- Educational experiences: The ABG does not offer outdoor educational programs related to botany, but it has classrooms which can be used by the ABG. The ABG has no exhibition space, but the school has many large plazas which can serve this purpose. The ABG does not have a meeting point, but a meeting point could be established next to each school gate (upper, middle and lower gates). The ABG has no museum, but it has an archive that could be further investigated. There is signage on buildings and facilities around the campus. Labels for plants and landscape elements need to be added. The ABG offers a trail that goes through the whole estate. The trail can be further developed into different experiences; children trail, birdwatching trail.

	Many large plazas in BHS can serve as exhibition areas.
	A meeting point could be established next to each entrance gate.

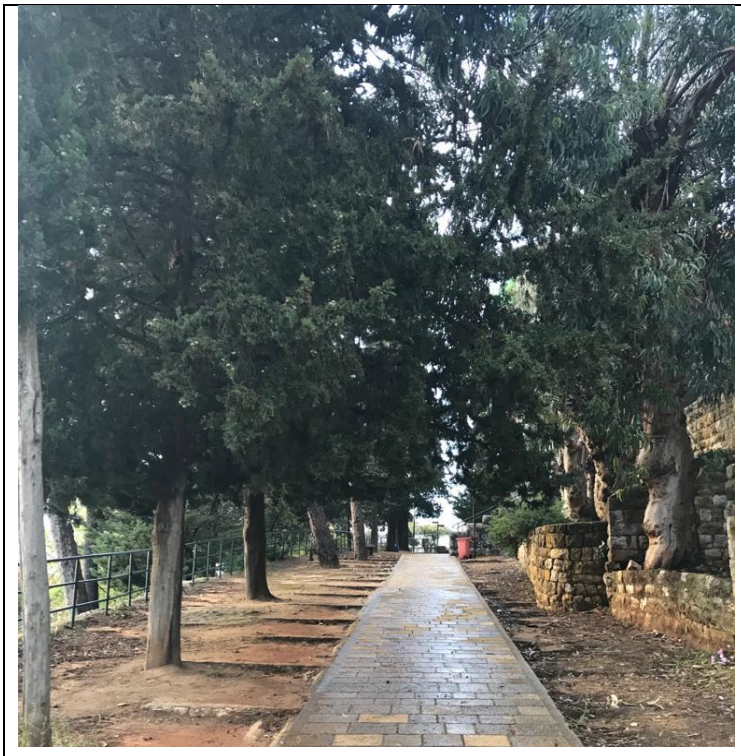
	The ABG has an archive that could be investigated and transformed into a museum.
	Signages are available in the campus, but plant labels and labels narrating ABG need to be added.

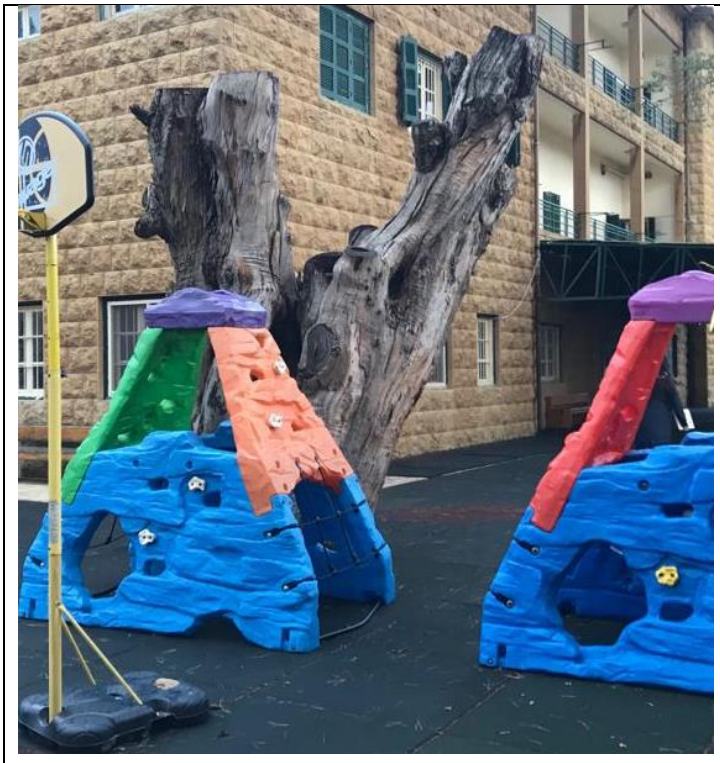
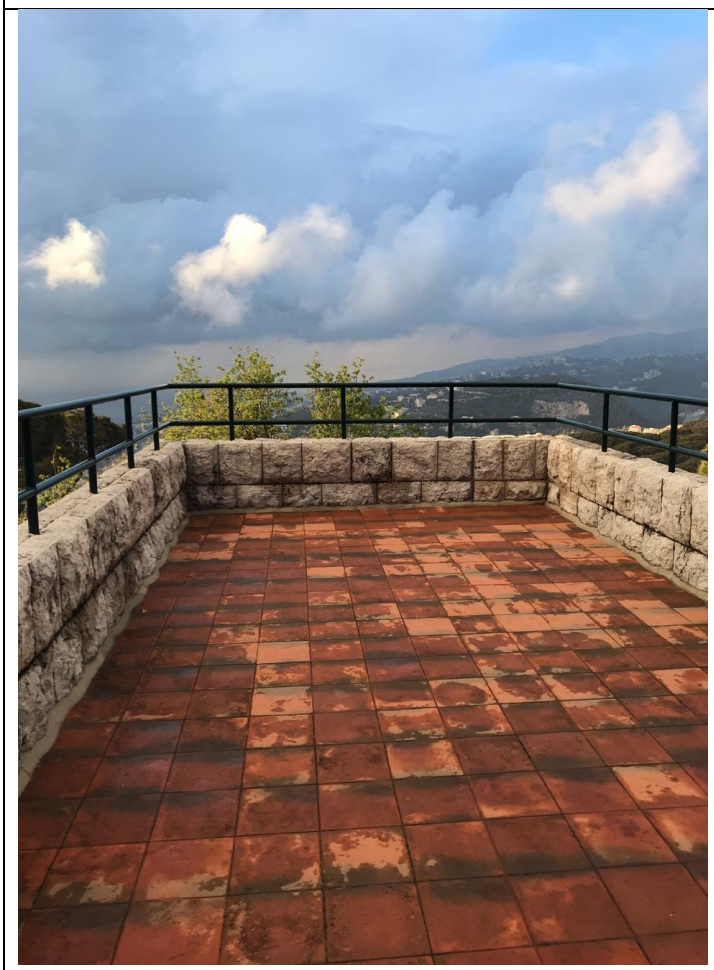
	The trail can be further developed into different experiences (birdwatching trail…)

- Social experiences: The ABG offers a large outdoor and indoor amphitheater and a pavilion. But it has no potential for weddings since it is not in line with the school mission. The ABG has its own restaurant, and there is potential for a barbecue area but safety measures need to be considered. The ABG has a bookshop that could sell botanical gadgets once the ABG is established.

	Amphitheater is available.

- Natural experiences: The site includes countless natural experiences, it has tree-lined avenue, treehouses, children playgrounds and viewing platforms to the mountains. The candidate could incorporate a picnic area, and a partial bike trail.

	Tree-lined avenue available in BHS
	Treehouse in BHS

	Children playground
	Viewing platform

- Cultural experiences: The candidate has a memorial for the school founder; however other memorials and monuments could be established. The school could ask their alumni to adopt a tree or a bench on campus, in this way these landscape elements could be in the memory of the alumni.

	Memorial for the school founder

- Facilities: the candidate has an administrative building, an education center and offers to the visitors the following facilities: parking, restroom, shelter, drinking water, first aid, but no phone.

The three case studies show the applicability of the guidelines but more importantly they show the extent to which ABGs could significantly broaden the role of botanic gardens, by transforming a large number of interspersed institution into botanical education venues and by engaging a broad base of citizens who are interested in offering access to their facilities for the sake of contributing to botanical education and re-establishing a link between people and nature.

CONCLUSION

Ancillary Botanic Gardens (ABGs) are one solution to challenges faced by botanic gardens. The ABG model shows how an inexpensive people-centered approach is possible. ABGs influence people in terms of their relationship with plants and their construction of plant knowledge based on local identity. They also empower people who want to contribute to nature conservation. ABGs are not only a venue to showcase native or traditionally used plants, but they are a platform that enables information exchange, and in some cases, reconstruction of stories and traditions brought in from the domestic arena. This study provides a clear direction on how to establish and develop an Ancillary Botanic Garden. More importantly, the guidelines are not prescriptive and do not require set mandates; rather their existence is driven by local agendas. Therefore, these guidelines are 'personalized' and can be tailored based on the resources and needs of each ABG.

The limitation of this study is that it does not include clear operational and administrative guidelines such as the human resources organization and legal issues facing ABG. This information was not readily available in the GardenSearch database and will need to be considered in future studies.

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APPENDIX I

1. Arboretum

Arboretum	Options
Elements and materials	- Softscape: grass, trees, flowers, shrubs - Hardscape: water feature, trail (gravel, soil or grass), rock boulders, benches, pergola
Size	- NA
Context	- Outdoor (Open space)
Circulation	- Wheelchair access - One level
Activities	- Walk - Jog - Sit - Rest - Take pictures - Observe the water feature
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	- Focal point
Keyword search	- Arboretum
Sources	- https://goo.gl/images/JRyb2j - https://goo.gl/images/xwBc5S - https://goo.gl/images/psaUMK - https://goo.gl/images/XrYTmA - https://goo.gl/images/hrKDkZ

2. Conservatory

Conservatory/ Plant Conservation area	Options
Elements and materials	- Softscape: potted plants - Hardscape: the conservatory is a glasshouse (made of glass and steel), chairs, sculpture, wooden handrail, metal railing for the path
Size	- 150 - 400m^2
Context	- Building by itself - Or indoor entity (GF area)
Circulation	- One level - Wheelchair access

Activities	- Sit - Observe - Stand
General Program	- Educational - Leisure
Accessibility	- Accessible from the trail
Other	- People observe the plants from behind the railing - Allow groups
Keyword search	- Plant conservatory
Sources	- https://goo.gl/images/JAkbEr - https://goo.gl/images/ELYiSk - https://goo.gl/images/u4WgRh - https://goo.gl/images/TZEx8j - https://goo.gl/images/DbstQm

3. Fauna

Fauna	**Options**
Elements and materials	- Softscape: soil surface for the animals - Hardscape: paved surface, wooden path, metal fence or wooden fence with ropes, bench
Size	- NA
Context	- Outdoor - Entity by itself
Circulation	- Wheelchair access - One level
Activities	- Walk - Observe the animals - Feed the animals
General Program	- Leisure - Educational
Accessibility	- Accessible from the trail

Other	- Some gardens have a zoo-like section - Butterflies are put in glasshouses
Keyword search	- Fauna botanic garden
Sources	- https://goo.gl/images/wSW1BK - https://goo.gl/images/c2UMF7 - https://goo.gl/images/p7uE4R - https://goo.gl/images/GAoVP2 - https://goo.gl/images/B3q9qH

4. Nursery

Nursery	**Options**
Elements and materials	- Softscape: hanging plants, potted plants - Hardscape: glass and steel structure, asphalt or gravel or paved surface, wooden or metal tables, gravel path or soil with carpet, chairs, pots, labels
Size	- 100 m^2
Context	- Entity by itself
Circulation	- One level - Wheelchair access in most of the nurseries - The spacing of plants defines the circulation
Activities	- Sit - Walk - Observe - Learn
General Program	- Educational
Accessibility	- Accessible from the trail
Other	- It is a greenhouse or a glasshouse - Plants organized based on species - It can sell plants too - Guided tours - Allow groups
Keyword search	- Nursery botanic garden
Sources	- https://goo.gl/images/WdUmvo - https://goo.gl/images/9azWhr - https://goo.gl/images/4imDp5 - https://goo.gl/images/Efg1bz

	- https://goo.gl/images/Y4p9DD

5. Plant collection

Plant Collection	Options
Elements and materials	- Softscape: trees, shrubs, grasses, flowers - Hardscape: soil or gravel path, labels, glass and metal structure (glasshouse)
Size	- NA
Context	- Outdoor or Indoor (glasshouse) - Entity by itself
Circulation	- Wheelchair access - One level
Activities	- Walking
General Program	- Educational
Accessibility	- Accessible from the trail
Other	- The collections can be outdoor in open air or indoor in glasshouses. However, in both cases, these collections are groups of plants grown for a defined purpose; they can be categorized as ecological, geographical, taxonomic or thematic living collections.
Keyword search	- Plant collection botanic garden
Sources	- https://images.app.goo.gl/8yyuogwkvaKVmupr6 - https://images.app.goo.gl/PG7NWXfM4f7c9ofu5 - https://images.app.goo.gl/3LC75hhY1gTWvU6E6 - https://images.app.goo.gl/DFjVsHKXjkEG3RY79 - https://images.app.goo.gl/KPvzdhbBr99Rdc4n7

6. Herbarium

Herbarium	Options
Elements and materials	- Softscape: plants for display - Hardscape: glass tables with wooden base displaying the plants, informative papers on the wall, metal lockers for storage, envelopes/files to store plants, carton boxes for storage, wooden stands
Size	- 10 - 50m^2

Context	- Indoor, it is a section of the building outside the gallery or a building by itself
Circulation	- Wheelchair access in some (1 level) - Two levels (ladder)
Activities	- Walk - Observe
General program	- Educational
Accessibility	- Accessible from the trail
Other	- Display area - Allow groups - Sometimes the way the plants are stored is revealed to the public - Guidance is needed
Keyword search	- Herbarium botanic garden
Sources	- https://goo.gl/images/U1RtmZ - https://goo.gl/images/8Ts3Pc - https://goo.gl/images/x7Gtj2 - https://goo.gl/images/Y3Q43b - https://goo.gl/images/Ge5cWh

7. Research center

Research Center	Options
Elements and materials	- Softscape: trees, shrubs, flowers - Hardscape: concrete or glass building, paved surface, water feature
Size	- NA
Context	- Building by itself
Circulation	- Wheelchair access - One level
Activities	- Conduct studies (for researchers) - Learn (for visitors)
General Program	- Educational
Accessibility	- Accessible from the trail
Other	- Preferably a green building - Exhibitions featuring garden research and conservation work shown in the hall or lobby of the center
Keyword search	- Research center botanic garden
Sources	- https://goo.gl/images/Ya1kAz - https://goo.gl/images/odh2QE - https://goo.gl/images/q4oehU - https://images.app.goo.gl/4TygXgTe1uPSC7pE9 - https://images.app.goo.gl/HQBt5W2ncYA3fnrNA

8. Seed bank

Seed Bank	Options
Elements and materials	- Hardscape: wooden tables with glass display and info boards, metal cabinets with jars containing seeds, machine to measure temperature of the seeds
Size	- 100 – 50 m^2
Context	- Indoor - It can be part of a building or building by itself
Circulation	- Wheelchair access - One level
Activities	- The majority of seed banks in botanic gardens are not accessible for visitors
General Program	- No activities for visitors - Education (if access is granted)
Accessibility	- Accessible for scientists
Other	
Keyword search	- Seed bank botanic garden
Sources	- https://goo.gl/images/UQP7QD - https://goo.gl/images/xuFtQR - https://goo.gl/images/nreMoq - https://goo.gl/images/AmBvoX - https://goo.gl/images/a9GLtT

9. Fountain

Fountain	Options
Elements and materials	- Softscape: shrubs around the fountain - Hardscape: paved surface, benches, water fountain made of stone
Size	- 10-20 m^2
Context	- Open space
Circulation	- Wheelchair access - One level
Activities	- Sit

	- Walk - Observe
General Program	- Leisure
Accessibility	- Part of the trail
Other	- The fountain acts as a roundabout
Keyword search	- Fountain botanic garden
Sources	- https://goo.gl/images/9R8Jgz - https://goo.gl/images/EU2Lqj - https://goo.gl/images/Emrw7Z - https://goo.gl/images/DHuJdm - https://goo.gl/images/SgeyqV

10. Lake

Lake	**Options**
Elements and materials	- Softscape: grass, trees - Hardscape: wooden deck, asphalt (paved area), bench, boat, gazebo, amphitheater, metal fence with a chain or a wooden fence, lighting, a deck that goes through the lake
Size	- NA
Context	- Outdoor - Open space
Circulation	- Wheelchair access - Platform - One level
Activities	- Walk - Sit - Jog - Feed the animals
General Program	- Leisure
Accessibility	- Part of the trail
Other	- Wetland as a focal point - Elevated platform to view the wetland - Stage for performance

	- Deck beside the wetland assigned for walking
Keyword search	- Lake botanic garden
Sources	- https://goo.gl/images/a6vB5f - https://goo.gl/images/QSsv83 - https://goo.gl/images/3ZbLTB - https://goo.gl/images/Dfyixm - https://goo.gl/images/TDtvVf

11. Pond

Pond	**Options**
Elements and materials	- Softscape: grass, trees - Hardscape: paved or brick path, signage, deck over the pond
Size	- NA
Context	- Outdoor - Open space
Circulation	- One level - Wheelchair access
Activities	- Stand - Sit - Jog
General Program	- Leisure
Accessibility	- Part of the trail
Other	- Pond as a focal point - Walking beside the pond
Keyword search	- Pond botanic garden
Sources	- https://goo.gl/images/yaSNtN - https://goo.gl/images/kjFzk7 - https://goo.gl/images/vwrGWe - https://goo.gl/images/KoeJHg - https://goo.gl/images/pg43yQ

12. Wetland

Wetland	**Options**
Elements and materials	- Softscape: aquatic plants - Hardscape: paved area or wooden path, wooden deck, viewing platform, steel railing, labels with the name of plants, large natural stone boulders installed in the wetland to walk on
Size	- NA
Context	- Outdoor
Circulation	- Not usually wheelchair accessible - The path next to the wetland is wheelchair accessible
Activities	- Stand - Walk - Sit - Jog - Rest
General Program	- Leisure
Accessibility	- Part of the trail - Accessible from the trail
Other	- Wetland as a focal point - Wetland as corridor - Wetland as a play area - The path is over the wetland
Keyword search	- Wetland botanic garden
Sources	- https://goo.gl/images/ABMXL7 - https://goo.gl/images/oWPB3m - https://goo.gl/images/J596vJ - https://goo.gl/images/bSDDxK - https://goo.gl/images/guZGFf

13. Audio guide

Audio Guide	**Options**
Elements and materials	- Mobiles and earphones handed at the visitor education center, plant labels with barcodes or numbers
Size	- NA
Context	- NA

Circulation	- NA
Activities	- Learn
General Program	- Educational
Accessibility	- Part of the trail
Other	- The visitor refers to the number engraved or the barcode on the plant label to listen to the corresponding audio.
Keyword search	- Audio guide botanic garden
Sources	- https://images.app.goo.gl/WgoNitdnNAq9xzkq7 - https://images.app.goo.gl/zSiwUPyj7giTkXQb8 - https://images.app.goo.gl/2859SyXD5eFWkFGB9 - https://images.app.goo.gl/eP4R3eZzNB9r6yPv8 - https://images.app.goo.gl/fL6g9D1pcoUQJTUx6

14. Classroom/Educational Program/School program

Educational program	**Options**
Elements and materials	- Hardscape: concrete structure or glasshouse or metal-based canopy tent, table, chair, paved or gravel path, benches
Size	- $25m^2$
Context	- Open space - Outdoor
Circulation	- Wheelchair access - One level
Activities	- Learn - Walk
General Program	- Educational
Accessibility	- Accessible from the trail
Other	- The majority of the educational programs are for adults
Keyword search	- Educational program botanic garden
Sources	- https://goo.gl/images/BdF9Hq - https://goo.gl/images/HSaL5v - https://goo.gl/images/6ZBWVY

	- https://goo.gl/images/AEGSrb - https://goo.gl/images/juzgvo

15. Exhibition

Exhibition	Options
Elements and materials	- Softscape: shrubs, potted plants - Hardscape: Glass or PVC structure, paved surface, asphalt or gravel path, wooden railing, concrete benches, information board, water feature, metal monuments, sculptures
Size	- 200m^2
Context	- Open air or indoor or in a glasshouse
Circulation	- Wheelchair access - One level - The spacing of plants determines the circulation
Activities	- Observe - Walk
General Program	- Educational
Accessibility	- Accessible from the trail - Part of the trail
Other	- Exhibition of plants and sculptures - Exhibitions could be organized for kids (train)
Keyword search	- Exhibition botanic garden
Sources	- https://goo.gl/images/be41cm - https://goo.gl/images/SUCsTa - https://goo.gl/images/f7Cncb - https://goo.gl/images/P5fy9G - https://goo.gl/images/4nSJHc

16. Library

Library	Options
Elements and materials	- Hardscape: wooden chairs and tables, wooden or steel bookshelves
Size	- 100 - 150 m^2

Context	- Indoor
Circulation	- Wheelchair access - One level
Activities	- Read
General Program	- Educational
Accessibility	- Accessible from the trail
Other	- The books cover topics ranging from horticulture, landscape design, agriculture, flower arrangement, botany, and fauna
Keyword search	- Library botanic garden
Sources	- https://images.app.goo.gl/6go2xt4rxHXzf8k99 - https://images.app.goo.gl/gdeQLxPJzFzHsz5NA - https://images.app.goo.gl/SAevawtzFNg6mC2t7 - https://images.app.goo.gl/o7n9Nz5KQ2YZM5Uu8 - https://images.app.goo.gl/ztSCsVuPswRtsLjm9

17. Meeting point

Meeting Point	**Options**
Elements and materials	- Hardscape: glass or metal signage, structure - Softscape: Landmark tree
Size	- 3m height, 1m width
Context	- Outdoor or Indoor in the visitor education center
Circulation	- Wheelchair access - One level
Activities	- Stand (wait for the tour to start)
General Program	- Educational
Accessibility	- Accessible from the trail - Part of the trail
Other	- The meeting point is a focal point, it could be a large tree, a monument, or a signage
Keyword search	- Meeting point botanic garden - Meeting point
Sources	- https://images.app.goo.gl/N5S7jVS9DDXBiZLB6 - https://images.app.goo.gl/pW8avcoyNipWNZRZ9 - https://images.app.goo.gl/jZuFhmQWPfHPn2Y38 - https://images.app.goo.gl/SkgtD28a6TJyx8bk9

	- https://images.app.goo.gl/geJRGeV31ETUYqgb8

18. Museum

Museum	Options
Elements and materials	- Hardscape: wooden cabinet with glass façade, jars in the cabinets, glass table, paintings
Size	- 30 - 50m^2
Context	- Indoor, it is a room or a building
Circulation	- Wheelchair access - One level
Activities	- Walk - Observe
General Program	- Educational
Accessibility	- Accessible from the trail
Other	- Display area
Keyword search	- Museum botanic garden
Sources	- https://goo.gl/images/Rd6jaZ - https://goo.gl/images/WYse4g - https://goo.gl/images/tLzK1t - https://goo.gl/images/LyUTn2 - https://goo.gl/images/4zbZDA

19. Signage and information board

Signage	Options
Elements and materials	- Hardscape: concrete or metal base with info printed on it
Size	- 0.5 m height, 1 m width
Context	- Outdoor
Circulation	- Wheelchair access - One level
Activities	- Read
General Program	- Educational
Accessibility	- Part of the trail

Other	
Keyword search	- Signage botanic garden
Sources	- https://goo.gl/images/gs7AyK - https://goo.gl/images/8Mzjxz - https://goo.gl/images/9bYxE1 - https://goo.gl/images/tMZofJ - https://goo.gl/images/PRf7JS

20. Tours and trail

Tours and Trail	**Options**
Elements and materials	- Hardscape: gravel or soil or wood or asphalt path, steel or wooden railing if necessary, signage
Size	- 1.5 - 2 m width
Context	- Open space
Circulation	- Wheelchair access - The path can be elevated
Activities	- Walk - Bike
General Program	- Leisure
Accessibility	- Part of the trail
Other	
Keyword search	- Trail botanic garden
Sources	- https://goo.gl/images/SRLLD2 - https://goo.gl/images/j1BrWJ - https://goo.gl/images/pgC287 - https://goo.gl/images/3xddmy - https://goo.gl/images/pDmDmU

21. Amphitheater

Amphitheater	**Options**
Elements and materials	- Softscape: grass or soil surface, potted plants - Hardscape: paved surface, concrete or wooden benches, wooden platform in the middle, steel railing, concrete stairs

Size	- NA
Context	- Outdoor/ Open space
Circulation	- Lower platform → stairs → upper platform
Activities	- No wheelchair access to the upper platform
General Program	- Stand - Sit - Watch the performance
Accessibility	- Accessible from the trail
Other	- The amphitheater has a semi-circle or fan-like shape
Keyword search	- Amphitheater botanic garden
Sources	- https://goo.gl/images/v4gc32 - https://goo.gl/images/4JFLHn - https://goo.gl/images/wCV2ky - https://goo.gl/images/NzZiwS - https://goo.gl/images/bxomKE

22. Barbecue

Barbecue	**Options**
Elements and materials	- Softscape: grass surface - Hardscape: paved surface, metal canopy tent (if needed), metal BBQ, wooden bench, steel countertop for electric BBQ, chairs, path
Size	- 20 - 100m^2
Context	- Open space or shaded space
Circulation	- Wheelchair access
Activities	- Stand - Eat - Rest - Observe - Sit - Cook
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	- Allow groups

Keyword search	- Barbecue botanic garden
Sources	- https://goo.gl/images/xPoZU2 - https://goo.gl/images/B23Dc7 - https://goo.gl/images/AVWjqP - https://goo.gl/images/8wyN1V - https://goo.gl/images/ypHHxe

23. Gift shop

Gift Shop	**Options**
Elements and materials	- Hardscape: wooden shelves, metal stands, cashier
Size	- 15 m^2
Context	- Indoor - Part of a building
Circulation	- Wheelchair access - One level
Activities	- Buy gadgets
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	- The shop sells mugs, t-shirts, bags, pots, plants, cards, toys, seeds
Keyword search	- Gift shop botanic garden
Sources	- https://goo.gl/images/bdiR5M - https://goo.gl/images/HFMj8Y - https://goo.gl/images/VNZ7JC - https://goo.gl/images/E2d5oW - https://goo.gl/images/hU38gW

24. Pavilion

Pavilion	**Options**
Elements and materials	- Hardscape: metal or wooden or concrete structure, benches or chairs, stairs, asphalt path
Size	- 20 - 100 m^2

Context	- Building by itself
Circulation	- Wheelchair access - One level
Activities	- Stand - Sit
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	
Keyword search	- Pavilion botanic garden
Sources	- https://goo.gl/images/SMHUho - https://goo.gl/images/GdSbDh - https://goo.gl/images/J5gick - https://goo.gl/images/fWrkZ6 - https://goo.gl/images/Kwevp9

25. Restaurant - Café

Restaurant - Café	**Options**
Elements and materials	- Hardscape: concrete or steel building with glass windows, asphalt path, parasol, chairs, tables, terrace (wood or paved)
Size	- NA
Context	- Indoor and outdoor - Building by itself
Circulation	- Wheelchair access - One level
Activities	- Eat - Sit
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	

Keyword search	- Restaurant botanic garden
Sources	- https://goo.gl/images/xFrzqy - https://goo.gl/images/K8neFb - https://goo.gl/images/BzbgDC - https://goo.gl/images/f3Zy5b - https://goo.gl/images/eJeJXX

26. ***Wedding***

Wedding	**Options**
Elements and materials	- Softscape: grass, flowers, trees - Hardscape: paved area, glasshouse, wooden or steel or stone chapel, tables, benches, chairs, path
Size	- 36 – 50 m^2
Context	- Building by itself (indoor) - Outdoor space
Circulation	- Wheelchair access - One level
Activities	- Wedding ceremony
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	
Keyword search	- Wedding botanic garden
Sources	- https://goo.gl/images/H4k444 - https://goo.gl/images/v7rNAt - https://goo.gl/images/JHWeCB - https://goo.gl/images/UP9KvK - https://goo.gl/images/q4U4pt

27. Avenue

Avenue	**Options**
Elements and materials	- Softscape: soil, trees, climbers

	- Hardscape: gravel or paved surface, benches, water feature, steel structure or stone column to create the tunnel
Size	- NA / 50m^2
Context	- It is a tunnel; it leads to a place in the garden
Circulation	- One level - Wheelchair access (unless it is gravel)
Activities	- Sit - Walk - Jog
General Program	- Leisure
Accessibility	- Part of the trail
Other	- Corridor style
Keyword search	- Avenue botanic garden
Sources	- https://images.app.goo.gl/pEoEyWb59Uf98RUW6 - https://images.app.goo.gl/zg35rwGG67LtVkwt7 - https://images.app.goo.gl/iQu84zRZoMGEU3Fv7 - https://images.app.goo.gl/pitA41Y9TvuTPx3F7 - https://images.app.goo.gl/StupWCYB1R1Q6Mxm9

28. Bike trail

Bike trail	Options
Elements and materials	- Hardscape: small gravel or wooden or asphalt trail, steel railing
Size	- 1 -2 - 3.5 m wide
Context	- Outdoor
Circulation	- No Wheelchair access
Activities	- Bike - Walk - Jog
General Program	- Leisure
Accessibility	- Accessible from the trail - Or part of the trail
Other	
Keyword search	- Bike trail
Sources	- https://goo.gl/images/Wkvw3Z - https://goo.gl/images/DXwdL2 - https://goo.gl/images/vfEvgy

	- https://goo.gl/images/wE9aeX - https://goo.gl/images/uEP5Uj

29. Children playground

Children Playground	Options
Elements and materials	- Softscape: trees, sand pits, soil or grass surfaces - Hardscape: plastic or steel playground equipment, concrete surface around the playground, poured rubber surface for the playground, wooden or concrete benches, stairs, wooden railing, wooden fence
Size	- NA
Context	- Open space
Circulation	- Wheelchair access in the lower platform - In the upper platform, there is no wheelchair access
Activities	- Play - Sit
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	
Keyword search	- Children playground botanic garden
Sources	- https://goo.gl/images/Tos9MA - https://goo.gl/images/eNQt6U - https://goo.gl/images/Zjpy4V - https://goo.gl/images/XLEPUh - https://goo.gl/images/3h3fvH

30. Picnic

Picnic	**Options**
Elements and materials	- Softscape: grass - Hardscape: chairs provided by the garden, metal canopy tent, mats, water feature, gazebo
Size	- NA

Context	- Outdoor - Open space
Circulation	- Wheelchair access
Activities	- Sit - Eat - Stand
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	
Keyword search	- Picnic botanic garden
Sources	- https://goo.gl/images/7Tmjdz - https://goo.gl/images/UNwuAD - https://goo.gl/images/e1PJ5D - https://goo.gl/images/xGHsbK - https://goo.gl/images/jwp6Yg

31. Plant sale

Plant Sale	**Options**
Elements and materials	- Softscape: potted plants - Hardscape: steel canopy tent, table, chair, pots
Size	- 40 – 100 m^2
Context	- Outdoor - Open space
Circulation	- Wheelchair access - One level
Activities	- Buy plants
General Program	- Leisure
Accessibility	- Part of the trail
Other	- The plant sale is an event which takes place during occasions and not all year long (temporary)
Keyword search	- Plant sale

Sources	- https://images.app.goo.gl/S8Q52kJpaZoekBVD6 - https://images.app.goo.gl/atZ6SPjKXbwVJaN36 - https://images.app.goo.gl/6aCM1WGuaamXKd737 - https://images.app.goo.gl/M3gZ78gTsdqg65et5 - https://images.app.goo.gl/nJwpZLhgJQB6KMva6

32. Treehouse

Treehouse	**Options**
Elements and materials	- Softscape: trees, shrubs - Hardscape: asphalt road, wooden platform, steel ladder, steel or wooden or stone treehouse, rope railing
Size	- 12 m^2
Context	- Embedded in trees - Elevated - Overlooking
Circulation	- Wheelchair access to the first platform → ladder → viewing platform
Activities	- Walk - Stand
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	- Allow groups - Majority of treehouses is made of wood
Keyword search	- Treehouse botanic garden
Sources	- https://goo.gl/images/JvPXvQ - https://goo.gl/images/dqJWSb - https://goo.gl/images/5TZ44w - https://goo.gl/images/s21VQ6 - https://goo.gl/images/Xp246d

33. Viewing platform

Viewing Platform	**Options**
Elements and materials	- Hardscape: elevated steel or concrete or wooden deck, metal or glass or wooden railing, water feature, wooden or concrete path, paved surface
Size	- NA

Context	- Outdoor / Open space - Embedded within trees - Elevated
Circulation	- Wheelchair access in some viewing platforms - No wheelchair access; soil surface, stairs, upper platform
Activities	- Stand - Observe - Walk - Jog
General Program	- Leisure
Accessibility	- Accessible from the trail
Other	
Keyword search	- Viewing platform botanic garden
Sources	- https://goo.gl/images/DdDWYo - https://goo.gl/images/AXP3Cf - https://goo.gl/images/NMgSj9 - https://goo.gl/images/L4mBZU - https://goo.gl/images/jAumUq

34. Memorial

Memorial	**Options**
Elements and materials	- Softscape: shrubs - Hardscape: paved surface, stairs leading to the memorial, sculpture or monument
Size	- 40m2
Context	- Overlooking, elevated, embedded in nature - Building by itself
Circulation	- No access for wheelchair - Trail (lower platform)→ stair→ memorial
Activities	- Walk - Observe
General Program	- Educational
Accessibility	- Accessible from the trail

Other	- The memorial acts as a landmark
Keyword search	- Memorial
Sources	- https://goo.gl/images/Bg5gfi - https://goo.gl/images/er4NTb - https://images.app.goo.gl/NKKV6y4r1ro1LZ4BA - https://images.app.goo.gl/nR95VNTF6PGvfo3aA - https://images.app.goo.gl/GmM1PjhzMig6X8Wv5

35. Sculptures and monuments

Sculptures and Monuments	**Options**
Elements and materials	- Softscape: topiary, shrubs around the monument, soil surface under the monument - Hardscape: gravel or paved surface, around the monument. stairs leading to the monument, metal or stone sculpture
Size	- 25 m2
Context	- Outdoor ` - Open space
Circulation	- Wheelchair access - It could be 2 levels, no wheelchair access to the monument in the upper platform
Activities	- Walk by - Observe - Walk through it
General Program	- Leisure
Accessibility	- Part of the trail - Next to the trail
Other	- It acts as a roundabout - Kids can walk through the sculpture
Keyword search	- Sculptures botanic garden - Monuments botanic garden
Sources	- https://goo.gl/images/62P5eM - https://goo.gl/images/TQN6VF

	- https://goo.gl/images/tiQXou - https://goo.gl/images/a4MUUk - https://goo.gl/images/Yhb3Ry

36. Historic section

Historic Section	Options
Elements and materials	- Signage
Size	- NA
Context	- Outdoor
Circulation	- Wheelchair access
Activities	- Learn
General Program	- Educational - Leisure
Accessibility	- Accessible from the trail
Other	- It is a section in the garden; For instance, you can find it signaled on the garden map "historic section here" or you can find a section that represents a historic background in the garden i.e. civil war section in spring grove cemetery
Keyword search	- Historic section botanic garden

APPENDIX II

ABG Introductory Document

How to establish an ancillary botanical garden (ABG)

In 2014, AUB in collaboration with RBGE proposed a new concept for botanic gardens; Ancillary botanic gardens. The purpose behind this novel concept is to encourage the public in joining efforts to promote plant conservation by establishing botanic gardens. With this new concept, individuals and institutions can now transform open areas that they own into botanic gardens.

Definition

'Ancillary botanic gardens' (ABG) is a new category of botanic gardens. Synonyms of the term ancillary include 'secondary', 'additional' and 'supporting'. The key aspect of ABGs is that they are secondary on a spatial level and established on lands already assigned a primary purpose; they can be established in schools and university campuses, private estates, private institutions, touristic sites, archaeological sites, and religious landholdings. In summary, an ABG is an area set aside for the growing and display of plants in an estate or institution.

Purpose

The purpose of an ABG, be it large or small, is to grow and manage plants, keep them labeled, and provide educational opportunities to visitors. This does not preclude the fact that ABGs can be used for recreational purposes. The objectives considered by people interested in establishing botanic gardens are many; for example they can promote native plants, show plants with historical significance, showcase plants with a

landscape value, shed light on the ecological and environmental values of plants, or provide a display of plants with cultural, edible, or medicinal value. People should not be deterred from establishing an ABG because the educational scope will vary based on their capacity and willingness to maintain the ABG. The important thing is to offer an opportunity for people to learn about plants in the community where the ABG is established. The new ABG concept is adaptable to various communities including private sector, public sector, civil society, educational communities, urban communities, and rural communities. With this new concept and its newly established Botanic Garden AUB hopes to encourage more and more people to become interested in growing and caring for plants on their premises.

Ancillary Botanic Gardens Help Preserve Local Culture

At the cultural level, ABGs have an additional contribution in that they engage new constituencies because they may rely on local plant names. This will help sustain the transfer of traditional and ethnobotanical knowledge and facilitate the link between plants and people. ABGs could play an important supporting role because they act as 'custodians' for traditional land management practices and ethno-ecological knowledge.

Ancillary Botanic Gardens Have an Educational Purpose

A key aspect of ABGs is that unlike botanic gardens, their roles and scope are not prescribed by international standards. This however should not lead to the conclusion that ABGs are 'mere' public parks or pleasure gardens because they are implemented following a locally driven educational and outreach mission.

APPENDIX III

Ancillary Botanic Garden Registration

GARDEN NAME

Name of the institution or a selected name affiliated with the institution

PHOTO OF GARDEN

Photos representative of the living collections and facilities

GARDEN LOCATION AND CONTACT DETAILS

Street address City Country Phone Fax Email Website Social media

CONTACT PERSON (S)

Name of person in charge Phone Email Name of person responsible for visits and tours Phone Email Name of person responsible for garden management Phone Email

TYPE OF INSTITUTION

Public property Private property Corporate/business/tourism University/school/research institution Municipal Archeological/cultural Religious landholding Other

DESCRIPTION OF INSTITUTION - PRIMARY SPACE FUNCTION

Describe the institution, its mission, its operation

HISTORY OF THE INSTITUTION AND THE GARDEN (250 WORDS)

Provide a historical background of the institution

FOUNDING DATE OF THE INSTITUTION

Provide founding date of institution

OPERATIONAL HOURS

Provide information on opening days and hours for public

TARGET VISITORS

Community
Students/youth
Clients
Tourists
Other

PHYSICAL DATA

Garden area (m^2)
Latitude
Longitude
Annual Rainfall (mm)
Altitude (m)

PLANT COLLECTION TYPE

Geographic (specify the country/region of origin of the collection)
Thematic (specify the theme of the collection)
Ecological (specify the habitat or the ecotype of the collection)
Taxonomic (specify the taxonomic group of the collection)

INFORMATION ON PLANT COLLECTION

Provide short description of the type of plants in the garden and the interesting aspects and best times to visit

PLANT COLLECTION LABELING

Are plants labeled by common name?
Are plants labeled by scientific name?

NUMBER OF SPECIES

Total Number of species

LIVING COLLECTION

Arboretum
Conservatory/Conservation area
Fauna
Nursery

RESEARCH AND CONSERVATION

Herbarium
Research center
Seed Bank

EDUCATIONAL ACTIVITIES

Audio Guide
Classroom/educational program
Exhibition
Library
Meeting point
Museum
Signage and Information board
Tours - Trail

SOCIAL ACTIVITIES

Amphitheater
Barbecue
Gift shop
Pavilion
Restaurant - Café
Wedding

NATURAL ACTIVITIES

Avenue
Bike trail
Children playground and trail
Picnic
Plant sale
Treehouse
Viewing platform

CULTURAL ACTIVITIES

Memorial
Sculptures and monuments
Historic section

SUSTAINABLE PRACTICES

Composting Bird feeders Rain water collection Solar light

ABG PARTNERSHIPS

Partner with academic institutions Partner with government agencies Partner with corporations Partner with non-profit organizations: