**Interactive taxonomic key for identification of urban trees in Belo Horizonte, Minas Gerais, Brazil**

**Flávia Faria; Ariadne Lopes & João Renato Stehmann**
Universidade Federal de Minas Gerais
**Key Words**: *Teaching and Learning, Technologies for Engagement and Learning*

## INTRODUCTION

The Natural History Museum and Botanical Garden of the Federal University of Minas Gerais (NHMBG/FUMG) is a forest reserve and has an area of 60 hectares, where 30 species of trees that are used in urban forestry in Belo Horizonte (Minas Gerais, Brazil) can be found (Faria et al., 2008). The urban trees are very important for the urban ecosystem and the quality of human life (Beatley, 2012; Silva Filho, 2013). Considering the continuous changes in the world and the growing distance between people and what is natural, urban trees are often the only interaction that people have with trees. However, recent work made us aware that people in urban cities do not know about urban biodiversity (Beatley, 2013). To teach people to recognize plants helps them to enjoy the natural areas they visit in the cities, and when they get to recognize them, they develop nature competency and skills to know more about nature and its importance to life.

Botanical gardens and other places of learning outside the classroom are important to connect people to plants, which many of these sites are trying to achieve by utilizing technology tools to approximate them to the public. An interactive taxonomic key for the identification of urban trees can facilitate the study of diversity in urban trees. There are many examples of software programs available for creating interactive keys, both commercially and free, including: Delta (Description Language for Taxonomy – http://delta-intkey.com), Lucid® (www.lucidcentral.org) and Xper® (version 2 – http://infosyslab.fr/ and version 3 – http://www.xper3.fr/). Some studies have recently been produced documenting the use of interactive keys in botanical identification and as a teaching tool in plant biology (Peres, 2012; Araújo & Miguel, 2014). The aim of the work in Belo Horizonte was to develop a Botany workshop based on an interactive taxonomic key for the identification of urban trees that occur in the NHMBG/FUMG area; getting the general public interested in plants and encouraging teachers to use the teaching material of this project with their students.

## METHODOLOGY

Firstly, we localized and identified the urban trees that occur in the NHMBG/FUMG area. A database was built that included morphological information of the leaves, illustrations of the vegetative characters and images of the species. To construct the interactive taxonomic key, two versions of the Xper program were used: Xper$^2$ (http://infosyslab.fr/) and Xper$^3$ (http://www.xper3.fr/). Additional material for the Botany workshop was also created, including exsiccatae, a dichotomous key and an illustrated glossary. As a pilot project, it built an interactive taxonomic key, using the Xper$^2$ program. This interactive key includes only 10 species of urban trees and is available at the Portal of Interactive Keys of Biodiversity (http://www.icb.ufmg.br/chaveonline/index.html). Figure 1 shows all the building process involved in the creation of the interactive taxonomic key

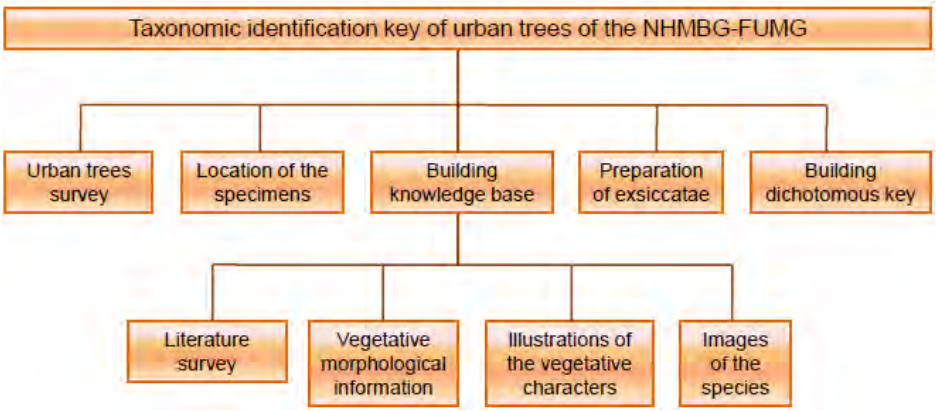


**Figure 1**: *The building process of the interactive taxonomic key of urban trees of the NHMBG/FUMG*.

**RESULTS AND DISCUSSIONS**

The 30 species of urban trees identified in the NHMBG/FUMG area are shown in the Table 1.

**Table 1**: *Species of urban trees that occur in the NHMBG/FUMG area. The species are arranged in alphabetical order of botanical families, followed by the common name and the origin.*

| FAMILIES/SPECIES | COMMON NAME | ORIGIN |
|---|---|---|
| ARECACEAE | | |
| *Caryota urens* Jacq. | Solitary fishtail palm | Exotic |
| *Roystonea oleraceae* (Jacq.) O.F. Cook. | Royal palm | Exotic |
| BIGNONIACEAE | | |
| *Handroanthus chrysotrichus* (Mart. ex DC.) Mattos | Golden trumpet tree | Native |
| *Spathodea campanulata* P. Beauv. | African tulip tree | Exotic |
| *Tabebuia roseoalba* (Ridl.) Sandwith | White trumpet tree | Native |
| *Tecoma stans* (L.) Juss. ex Kunth | Yellow trumpetbush | Exotic |
| BORAGINACEAE | | |
| *Cordia superba* Cham. | Cordia | Native |
| FABACEAE | | |
| *Bauhinia variegata* L. | Orchid tree | Exotic |
| *Caesalpinia pulcherrima* (L.) Sw. | Poinciana | Exotic |
| *Cassia grandis* L.f. | Pink shower tree | Native |
| *Clitoria fairchildiana* R.A.Howard | Sombreiro | Native |
| *Delonix regia* (Bojer ex Hook.) Raf. | Royal poinciana | Exotic |
| *Holocalyx balansae* Micheli | Alecrim-de-campinas | Native |
| *Jacaranda mimosifolia* D.Don | Blue jacaranda | Exotic |
| *Leucaena leucocephala* (Lam.) R. de Wit. | White leadtree | Exotic |
| *Libidibia ferrea* var. *leiostachya* (Benth.) L.P.Queiroz | Brazilian ironwood | Native |
| *Peltophorum dubium* (Spreng.)Taub. | Yellow poinciana | Native |
| *Samanea inopinata* (Harms) Barneby & J.W.Grimes | Rain tree | Native |
| *Senna macranthera* (DC. ex Collad.) H.S.Irwin & Barneby | False sicklepod | Native |
| *Senna multijuga* (Rich.) H.S.Irwin & Barneby | False sicklepod | Native |
| *Schizolobium parahyba* (Vell.) Blake | Brazilian firetree | Native |

| | | |
|---|---|---|
| LYTHRACEAE | | |
| *Lafoensia glyptocarpa* Koehne | Mirindiba-rosa | Native |
| *Lagerstroemia speciosa* (L.) Pers. | Resedá-gigante | Exotic |
| *Ceiba speciosa* (A.St.-Hil.) Ravenna | Silk floss tree | Native |
| MELASTOMATACEAE | | |
| *Tibouchina granulosa* (Desr.) Cogn. | Glory tree | Native |
| MELIACEAE | | |
| *Melia azedarach* L. | Chinaberry | Exotic |
| *Eucalyptus tereticornis* Sm. | Forest red gum | Exotic |
| *Syzygium cumini* (L.) Skeels | Jambolan | Exotic |
| SAPINDACEAE | | |
| *Sapindus saponaria* L. | Wingleaf soapberry | Native |
| RUTACEAE | | |
| *Murraya paniculata* (L.) Jacq. | Orange jasmine | Exotic |

The Figure 2 and Figure 3 show some examples of additional material for the Botany workshop. The homepage of the interactive taxonomic key collaborated with the figure 3 is shown in the Figure 4.

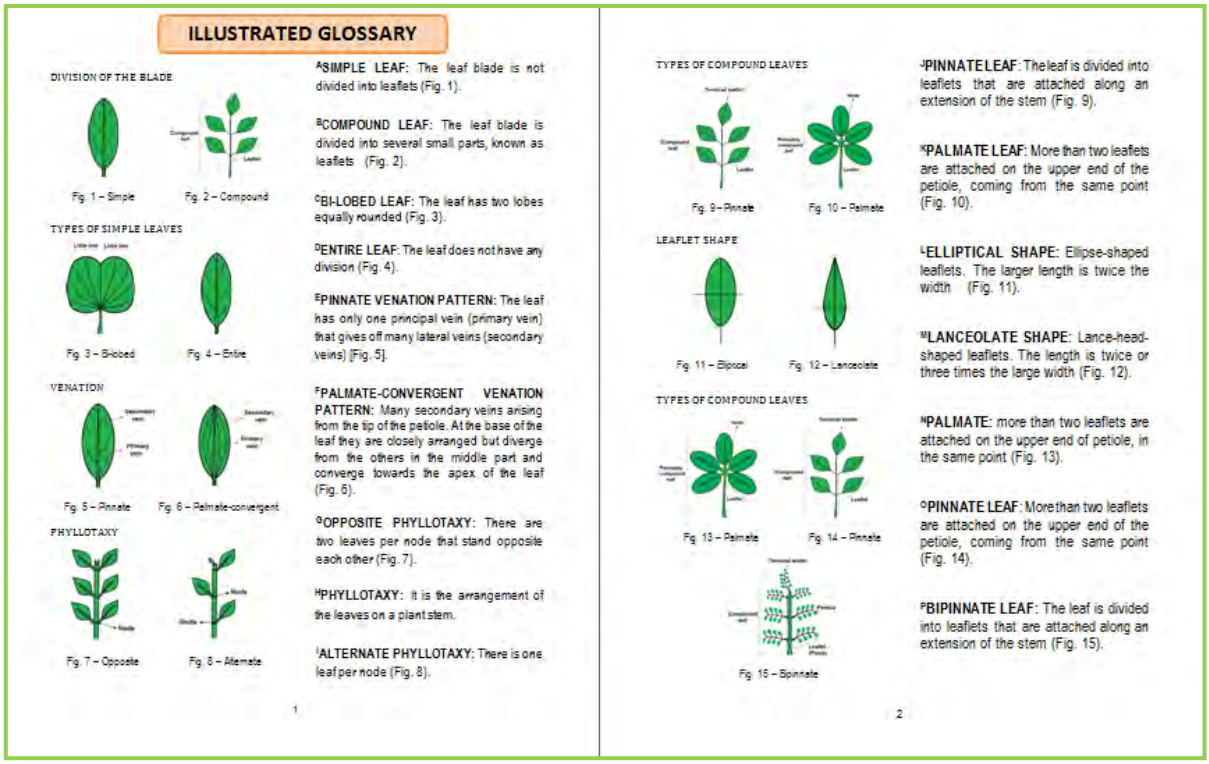


**Figure 2:** *Illustrated glossary as an additional material for the dichotomous key.*

URBAN TREES OF THE NATURAL HISTORY MUSEUM AND BOTANICAL GARDEN OF THE FEDERAL UNIVERSITY OF MINAS GERAIS

Ariadne Dias
Flávia Santos Faria
João Renato Stehmann

DICHOTOMOUS KEY

1.a. Palm ..... *Caryota urens*
1.b. Tree ..... 2
2a. Simple leaves[A] ..... 3
2b. Compound leaves[B] ..... 5
3a. Bi-lobed leaves[C] ..... *Bauhinia variegata*
3b. Entire leaves[D] ..... 4
4a. Pinnate venation pattern[E] ..... *Syzygium cumini*
4b. Palmate-convergent venation pattern[F] ..... *Tibouchina granulosa*
5a. Leaves with opposite[G] phyllotaxy[H] ..... 6
5b. Leaves with alternate[I] phyllotaxy ..... 8
6a. Pinnate leaves[J] ..... 7
6b. Palmate leaves[K] ..... *Handroanthus impetiginosus*
7a. Leaflets with elliptical shape[L] ..... *Spathodea campanulata*
7b. Leaflets with lanceolate shape[M] ..... *Tecoma stans*
8a. Palmate leaves[N] ..... *Ceiba speciosa*
8b. Pinnate or bipinnate leaves[P] ..... 9
9a. Bipinnate leaves ..... *Libidibia ferrea*
9b. Pinnate leaves ..... *Cassia grandis*

**Figure 3:** *Dichotomous key to identify 10 species of urban trees that can be found in the NHMBG-FUMG area.*

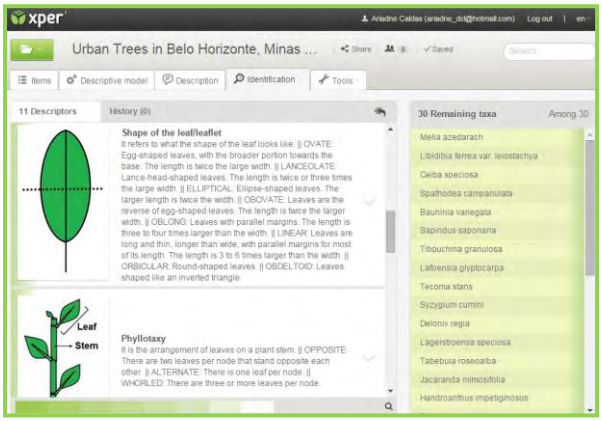


**Figure 4***: Homepage of the interactive taxonomic key (Xper[3]).*

The Botany workshop has been offered to a diverse range of public since 2014, including the staff at NHMBG/FUMG, Biology graduate students, Biology postgraduate students, Environmental technical student, visitors to the NHMBG/FUMG and some participants in the 9th BGCI International Congress on Education in Botanic Gardens (Figure 5-11). The Figure 12 shows the material that was used to do the workshop in the congress.

**Figure 5:** *Workshop with the visitors to the NHMBG/FUMG (Belo Horizonte, Minas Gerais, Brazil).*

**Figure 6:** *Workshop with Biology graduate students (Belo Horizonte, Minas Gerais, Brazil).*

**Figure 7:** *Workshop with trainees at the NHMBG/FUMG (Belo Horizonte, Minas Gerais, Brazil).*

**Figure 8:** *Workshop with Environmental technical students (Nova Lima, Minas Gerais, Brazil*).

**Figure 9:** *Tablet and exsiccatae as an additional material for the workshop at the 9th BGCI International Congress on Education in Botanic Gardens (Saint Louis, Missouri, USA).*

**Figure 10:** *Workshop at the 9th BGCI International Congress on Education in Botanic Gardens (Saint Louis, Missouri, USA).*

**Figure 11:** *Workshop at the 9th BGCI International Congress on Education in Botanic Gardens (Saint Louis, Missouri, USA).*

**Figure 12:** *Workshop at the 9th BGCI International Congress on Education in Botanic Gardens (Saint Louis, Missouri, USA).*

In general, the participants were really interested in the Botany workshop. According to them, the workshop has furthered their knowledge. The participants who completed the workshop commented that they found the theme of identifying urban trees very interesting. They also stated they would recommend the workshop to others. However, some of them reported that they felt there wasn't enough time to do the workshop, suggesting an increase in the time allowed to do the activity. It was clear how difficult some participants found identifying species using the dichotomous key and illustrated glossary. They took longer to identify the same species using the dichotomous key than using the interactive taxonomic key. Some participants worked in pairs or groups, resulting in interesting moments of dialogue and interaction among participants.

During the technology showcase at the 9th BGCI International Congress on Education in Botanic Gardens some participants told us that it has been a challenge making people interested in plants. Smartphones and others technologies are keeping people more connected with the world than they have ever been before; the activity shown in this work would utilize these new technologies and approximate the public with the natural world.

**CONCLUSIONS**

The interactive key is a good and simple tool to learn about plants. As a traditional taxonomic key, the dichotomous key allows the user to start identification from where the author sees fit. On the other hand, the interactive key allows the users to choose the character they want to start the identification with, which in many ways is much easier. An interactive taxonomic key of identification of urban trees and its

application in a Botany workshop has been useful in studying the diversity of urban trees. It has shown that is possible to disseminate botany content to a diverse public, approximating people to the trees of the city and to basic and important concepts related to plant morphology. Some botanical gardens do not have funds to create their own software, so Xper offers a great alternative. Furthermore the Xper program can be an interesting way to disseminate botanical information, making it possible to create itinerant zones of activity. The usability of the interactive key and all the available text and illustrations has contributed to the effectiveness of the Botany workshop. It is also a unique teaching tool for teaching botany, helping students to understand some morphological terms in an easier way. Considering the participants that have complained about the short time of the workshop (2 hours), we intend to transform it into a basic course of 'an introduction to plants identification' (8 hours).

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**The changing face of a Nigerian foremost University Botanical Gardens**

**Taiye R. Fasola**
Department of Botany, University of Ibadan, Ibadan, Oyo State, Nigeria
**Key Words**: *Teaching and Learning, Strategy and Future Vision for Greater Impact and Change*

## INTRODUCTION

Botanical gardens fulfill several roles related to in situ conservation of ecosystems worldwide, protecting plants from human overpopulation which results in the destruction of plants natural habitats. Botanical gardens therefore create awareness of the need for plant conservation and sustainability. As the case may be, conservation and sustainability have the same primary objectives. Several studies have demonstrated the uniqueness of various gardens that yet, still share the same one goal with others, of promoting conservation and sustainability (Jo, 2010; Williams, 2011; Donald and Sharon, 2013). This study was used as inspiration to bring out the responsive roles, interest and values of the first University Botanical Gardens of Nigeria.

## DESCRIPTION OF THE UNIVERSITY OF IBADAN BOTANICAL GARDEN

The University Of Ibadan Botanical Gardens (UIBG) established in 1948 is over 40 hectares of land that lies at, latitude $7^0$ 27′ North and longitude $3^0$ 54′ East. The botanical garden is a unit of the Botany Department with nine sections at the start but presently houses eleven. These include: an ornamental garden; the nursery section; the children's section with recreational gadgets; the arboretum that demonstrates the significant role trees play in our lives; the open field which is a space for retreats, wedding and other social engagements; the medicinal garden; a conservation area; the rose garden; the water and bog garden; and the rock garden. In recent years, the garden has transcended from being a field laboratory for teaching and research purposes only, to include other activities to generate income. Despite the increasing number of roles of the garden, the site still remains an image of its old self. In the light of this, the upgraded status of the garden became necessary in order to realize its full potential and benefits to the public. The face-lifting of the botanical garden plays an important role in educating and inspiring the public about the usefulness of plants and ethnobotany.

## THE GARDEN PROVIDES TO THE UNIVERSITY AND PUBLIC

The garden which now serves as a recreational, excursion, social engagement and lecture centre to the general public, has witnessed many documented events over time. The gardens main service is as a field laboratory in teaching and research to our students, as well as students and pupils from other schools on educational visits. The garden is used by the following departments within the university: Chemistry, Pharmacognosy, Biochemistry, Archaeology, Veterinary Medicine, Zoology and Faculty of Agriculture and Forestry. Some of the students from the faculty of arts also come for inspiration and meditation. The garden has also accommodated various categories of students from primary, secondary and tertiary schools on educational visits from across the country. Members of the larger community learn plant conservation and procure seedlings. In light of the expanding scope of services being rendered to the public, the children's section was introduced so as to encourage them to imbibe the culture of conserving plants. Lately the public has also been allowed access to the medicinal garden (Figure. 1) which affords people the opportunity to learn about plant uses. Many of the social activities take place in the open field (Figure. 2). In order to provide more facilities for recreation in the garden, six gazebos and a small hall were built.

Landscaping and horticultural promotion are aimed at both the public and private corporate bodies as well as individuals in activities such as bouquet and wreath making. The supply of seedlings and ornamentals has gone

a long way in contributing to biodiversity and plant conservation. The serene environment has promoted exciting picnics around the garden particularly at the gazebos. As an established institute the University Botanical Gardens in Nigeria, have been supportive to other universities and research institutes to set up their own gardens. Traditional knowledge of plants has been endowed by field experience on medicinal plants of which the medicinal garden was established. As a protected green area the garden provides facilities for recreation.

**PROBLEMS FACING THE GARDEN**

As discussed there are many factors that are changing the face of the garden, directing it towards a new future and hopefully overcoming its present challenges. In the past the garden had more ornamental plants and exchanged them and other plant materials with the rest of the world. There used to be an exchange program of plant seeds among botanical gardens worldwide; including institutions such as BGCI, Royal Botanic Gardens, Kew and African Botanical Gardens; which has now ceased to exist. Among the exchange plants introduced were *Gmelina arborea* and *Terculanea carpensis*. Some other exotic plants from the program serve as ornamentals within the ornamental garden (Fig. 3).

The garden is well known as it was established as an offshoot of the Royal Botanic Gardens, Kew when the University of Ibadan was affiliated with University College, London. At that time there were enough facilities, and members of staff were adequately trained under the guidance of Royal Botanic Gardens, Kew. The objectives for setting up the botanical garden were to promote botanical teaching and research with a focus on the conservation of plant diversity as a form of environmental protection. The objectives were to be met by raising seedlings of plants and encouraging the planting of trees. However, with dwindling resources, other objectives have been introduced. As an example, people now use the botanical garden for social engagements which has meant a shift in the gardens use and a move away from its main objectives.

Over the years, the garden has faced many challenges such as the unfortunate flood disasters that have ravaged the entire university and Ibadan metropolis. Sadly, the botanical garden is still flooded. The administrative offices are also greatly affected by flooding. Arising from the incessant flooding is the collapse of a pedestrian bridge which has been identified as a major source of low patronage to the garden. Added to this, is the current deplorable state and progressively eroded signage of the garden. All the aforementioned are reasons why the garden enjoyed more patronage in the dry season than the rainy season.

**Figure 1.** *A cross section of the medicinal Garden*


**Figure 2.** *An open space of the Gardens*


**Figure 3.** *Ornamental plant section of the Gardens*

**CONCLUSION AND RECCOMENDATIONS**

The botanic garden which is a shadow of its old self due to poor infrastructure can be upgraded by improving upon the infrastructures and facilities provided. Resuscitation of relationships that used to exist with other gardens is of importance to also catch up on conservation matters and link up with other related members. This help and assistance is desired. Re-introduction of disappeared plants is encouraged as well as enriched planting of disappearing plants. There is therefore the need to seek assistance and help to ameliorate the problems facing the gardens.

**ACKNOWLEDGEMENT**

The conference registration and accommodation provided by BGCI enabled author's attendance.

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**Strategic vision for the future, towards a new educational paradigm**

**Verónica Franco Toriz, Clarisa Jiménez Bañuelos and Lilia Carrillo Sánchez.**
Centro de Investigación Científica de Yucatán, A.C. Jardín Botánico Regional "Roger Orellana".
**Key Words**: *Teaching and Learning, Social Inclusion and Community Engagement*

The present contribution will address the journey that Mexican botanic gardens have been following in educational activities for more than 40 years .We will address the interesting process we undertake through our three workshops, oriented to make a critical analysis that has allowed us to create a concrete action plan for environmental education in our gardens; that set the guidelines to shape a new educational paradigm (Martínez, Franco and Balcázar, 2012).
The collaborative work during the process for the construction of the education action plan proved that the most dynamic field, or at least the more visible one in Mexican botanic gardens, is the education one. Efforts from Mexican educators have been summarized in three points in order to promote and highlight the institutional recognition of environmental education activities. These points are:

- a critical recapitulation from the past;
- strengthen present environmental and education actions mainly by staff training;
- the need to develop a strategic educational planning.

**THE EDUCATIONAL APPROACH.**
Since the establishment of modern botanic gardens, during the last 40 years, Mexican educators participating in the workshops recognized three main educational approaches in their institutions:

- The academic perspective mainly centered in teaching and learning names and taxonomical issues.
- The interpretive perspective, which includes the raise of awareness and a more integrated understanding of natural systems.
- The environmental education approach, in particular the critical perspective according to Sauvé (2003), which search for a more balanced and articulated perspective between the social and ecological dimensions.

The journey has not been easy or fast. It involved the exploration and critical review of the highly different ways to design and put in to action educational activities.
Once the educational approaches were identified we analyzed our educational elements in the data matrix shown in table 1, considering elements such as: activities performed by education staff; subjects or target groups; visitors and /or staff participation; the role of the botanic garden and the vision and knowledge it promotes. We describe these elements from different perspectives such as public dissemination, conservation, relationship (species/ecosystem) and knowledge of the territory, that, according to Revel, 1991, it is often seen as the fulfillment of a simultaneously selected place by its geographical, political, ethnic, and functional characteristics granted by history.

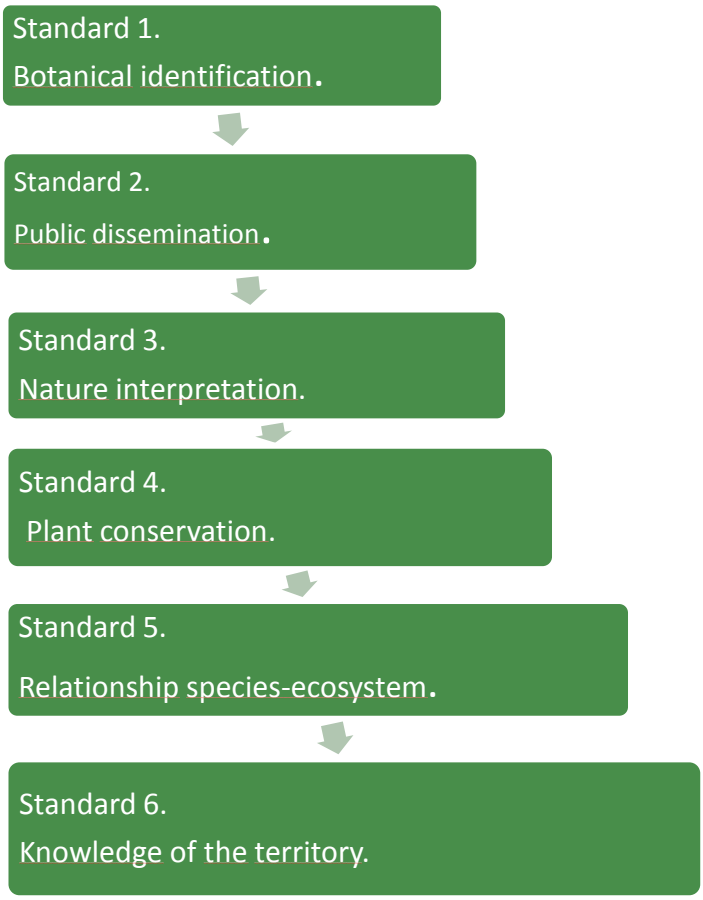
**Table 1.** *Self analysis matrix to identify the educational activities and their impacts.*

| Educational elements | Botanical identification | Public dissemination | Conservation | Species-ecosystem | Knowledge of the territory |
|---|---|---|---|---|---|
| Activities at the BG | | | | | |
| The subject | | | | | |
| Participation | | | | | |
| The role of the BG and the vision it promotes | | | | | |
| The knowledge it generates | | | | | |

Once we clarified our educational elements, in order to improve our educational performance we searched for the changes or new proposals we must adopt for better practices. Another issue for our self-analysis process included the question of the type of environmental education elements that predominate in each of our botanic gardens.

From this analysis, one of the most relevant and revealing collective outputs was the proposal of a typology of the kind and intensity of environmental education actions implemented in Mexican botanic gardens. In table 2 we illustrate this typology expressed in levels or standards as a result of the review of our programs and activities. This proposal intends to illustrate what activities are the most commonly performed by our gardens and its social impacts. A botanic garden may develop one or several standards without meaning that this makes it a better garden than another. It does not mean either, that each botanic garden must develop all the standards. This will be directly related with the possibilities and capacities of each garden. It will also depend on: plant displays and garden's facilities, trained and number of staff and the financial resources of the garden.

**Table 2**. *Levels or standards of the Mexican educational typology (Castro, 2009, in Martínez et al. 2012).*




**CHARACTERISTICS OF THE DIFFERENT LEVELS OR STANDARDS OF THE TYPOLOGY SUGGESTED.**

**Standard 1. Botanical Identification**

- It refers to the promotion of guided tours to disseminate knowledge of species through its technical labels.
- The role of the visitor is a viewer, a spectator.
- Success of the program is measured by the number of visitors and their retention of scientific names.
- Within this approach, prevails a divided and disciplinary outlook of nature. The educational process is thought in terms of what exists within the botanic garden vision. That is, there is an endogenous perspective of nature.
- It promotes isolated knowledge from society and its context. Little meaningful in the life of the individual.
- What matters is the scientific data and, of course, that the visitor learns it.

**Standard 2. Public Dissemination**

- Besides guided tours, the botanic garden organizes educational courses, workshops and training events

mainly in its facilities, to disseminate knowledge and value of some species.
- Criteria for measuring success revolve around the botanical information transferred to a number of people and an increase of persons who appreciate and may use the explained species.
- It has a pragmatic approach and also endogenous to the botanic garden.
- Nature is meant as a utilitarian or technical object.
- What is meant in this approach is that people know and appreciate the species for its use.

**Standard 3. Nature Interpretation**
- The botanic garden design paths and trails that allow the visitor to understand the importance and the meaning of the natural environment of the garden.
- The role of the subject is to internalize the meanings of the site.
- The garden promotes reflection and engagement of the visitor in plant conservation.
- This approach involves cognitive, emotional and behavioral aspects.

**Standard 4. Plant Conservation**
- This approach emphasizes the idea of educating for the protection of certain species mainly those that are important and/or useful.
- The botanic garden along with academic and government sectors organize campaigns to protect species that are considered "important".
- Success depends on achieving actions directly related to the species and their conservation (*ex situ* and *in situ* propagation and its reintroduction in natural ecosystems).
- In this perspective still prevails a vision of nature as an object (useful / fetishist); this level looks at natural resources outside their ecosystem context.
- This approach promotes links between botanic garden and society.

**Standard 5. Relationship Species-Ecosystem**
- It develops strategies not only to know the species, but also the ecosystems they inhabit.
- The botanic garden is linked to local ecosystems from within and outside his premises by convening various social sectors.
- The success criteria of this standard considered knowledge promotion and appreciation of ecosystems.
- It explores the relationship between nature and society, but does not question the split that has occurred between both elements.
- It generates an external perception of nature (there is something else outside the garden).
- Within this approach, what matters is to protect natural sites and therefore, species. Social participation refers to protection of natural ecosystems.

**Standard 6. Knowledge of The Territory**
- The botanic garden organizes workshops within different social sectors. From the knowledge of the territory (or its significance) are drawn livelihood projects.
- The success is the involvement of sectors to interpret the territory and the contribution of land-use management (statement of urban reserves, sites for water recharge and rain harvest, protect historical and cultural heritage). This means a concrete contribution from the garden in public policies.
- This perspective integrates a vision based on the territory. The botanic garden *is* a social actor.
- Understanding the territory creates clarity about the activities undertaken and new tasks are projected.

- The important of this perspective is that it changes the view of the territory and the vision of development.

Thus, there is a visible transit and maturation of the environmental education process in Mexican botanic gardens, moving from initiatives loaded with will and intuition, but with insufficient education formulations, towards more systematic and ongoing efforts including environmental education pedagogical elements and a complexity approach.

It has been a long and winding road, but this analytical process gave us a strategic, clear vision for the future that some years ago we did not have. The action plan will help us to direct the educational process as a combination of overlapped circles that includes dimensions such as nature, culture, places, ethics, time, technology, politics and people.

Challenges are huge. First we have to proceed with the implementation of the crucial actions identified by the educators; give continuity to the plan and eventually proceed to evaluate it in a medium and long term order; to be able to allow feed-back and a continual adjustment.

Nevertheless, this also implies good opportunities. With no doubt botanic gardens are significant cultural, scientific and educational institutions. We have the opportunity to develop educational material for the highly diverse ecological and cultural contexts of our country; we can foster new learning methodologies like inquire based science education, and above all we may contribute to the development of critical thinking in our society in order to raise awareness for environmental conservation.

Finally, the Environmental Education Plan for Mexican botanic gardens would not be in a printed version without the accompaniment and orientation of two excellent environmental educators from Mexico, Elba Castro and Javier Reyes, coordinator of the environment education masters and researcher-professor, respectively from the University of Guadalajara, in Mexico, and from the hard work of our colleagues, the educators from the Mexican botanic gardens.

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**Connecting People to Plants through Art**

**Felicity Gaffney,**
National Botanic Gardens of Ireland.
**Key Words:** *Teaching and Learning, Social Inclusion and Community Engagement*

**INTRODUCTION**

The National Botanic Gardens of Ireland is based in Glasnevin, a leafy suburb close to the centre of Dublin city. It provides a green oasis for the city and is much used and loved by its people. The visitor numbers have grown considerably in recent years from 120, 000 in 1990 to 541,946 in 2014. There are a number of contributing factors to this statistic, extensive, award winning, restoration works have been carried out not only on the world famous Curvilinear Range of Glasshouses, designed by Richard Turner, but on the Great Palm House too. Also, the development of Visitor Facilities culminating in the opening of the Education and Visitor Centre and Gallery space in 2000 led to increased visitors. It is without doubt however, that the extensive schedule of events, exhibitions and education programmes developed in the gardens during this time has been the chief motivator in developing the visitor numbers and encouraging the regular return visitors. The gardens have a wide and varied visitor profile with visitors from all walks of life. Engaging audiences through our exhibitions and art workshops has widened the scope of our audience further and indeed encouraged many people to visit exhibitions and engage with art that may never enter a traditional art gallery.

**SCULPTURE IN CONTEXT**

We hold a number of exhibitions every year but without doubt, the most successful is Sculpture In Context which is now in its 14th year. It is Irelands largest sculpture exhibition, with pieces placed all through the gardens, the glasshouses, the pond, water features and in the Gallery Space. Our first exhibition was held in 2002 with 75 pieces, this exhibition was so successful that it was decided to hold another one the next year and has now become an annual event in our calendar with over 160 pieces in the most recent exhibition held in 2014.

Sculpture in Context (SIC) came about when a group of artists joined together with the express intention of promoting Sculpture, exploring an alternative space to exhibit in, while taking the work beyond the normal gallery setting. Artists are asked to respond creatively to the gardens, creating new pieces especially for the exhibition that are in context with the botanic garden. The selection process is very rigorous, with a different panel of outside adjudicators judging the submissions every year.

Over 400 artists submitted work for selection this year and out of that 160 pieces were selected. The entire process is organised by a voluntary committee of artists who work in close consultation with staff from the gardens, who also give physical support during the installation process. It of course does have a big impact on the gardens during both installation and during the run of the exhibition. One would imagine that tensions would run high in any situation where you have over a hundred artists competing and vying for the best possible location for their work, however, things generally run very well and there is great cooperation between the artists and the gardening staff. As the staff are involved in the installation process there is an element of participation in the event and a level of ownership and support for the exhibition.

**Benefits to the Artists**

- The exhibition provides a unique platform for the artists to exhibit their works presenting an

opportunity to exhibit large scale pieces in an alternative setting.

- The exhibition provides an opportunity to expand the profile of sculpture reaching a wider audience. Many visitors who engage with the exhibition would not normally attend a 'regular' art gallery.
- It provides an opportunity to market and profile the work of the artist taking part in the biggest Sculpture exhibition held in the country.
- As there is a strict selection process, it is prestigious to be invited to exhibit.
- The exhibition requires invigilation in the gallery space and needs to be monitored outside also. Originally, this was managed by the staff in the Education team but it became too challenging to continue to do so with the downturn in the economy and the subsequent cut backs in staffing levels. A resolution to the problem was found by the SIC committee, as one of their members is lecturing in a nearby art college, it was suggested that a number of art students be given the opportunity of work experience for the duration of the exhibition. This provided them with the unique experience of being involved in mounting a large scale exhibition and also gave them sales, invigilation and business experience.

**Benefits to the Gardens**

- This exhibition is so successful that it has made the exhibition time September/October, the busiest time for visitors in the gardens. Over 100,000 visitors see the exhibition.
- It enriches the quality of the Visitor experience.
- It provides opportunity to interpret the collections in a new way.
- An Art education programme has evolved in tandem with the exhibition where final year Art Students interact and engage with the exhibition as part of their final Year project for Leaving cert. (equivalent to A level in British system)
- The exhibition is almost cost neutral as we work with the voluntary committee of Sculpture In context to make the exhibition happen.
- As it is such a popular event, we get a lot of exposure in the media, on a number of occasions even making the National six o'clock news on RTE. (Irish National T.V Channel)
- Example of the benefits of developing strong partnerships with a voluntary group.

**OTHER PARTNERSHIPS**

As mentioned previously, we host a number of exhibitions annually. There is always a brief that the exhibition must be of contextual significance, be it botanical, horticultural or environmental. Many of the most successful ones are organised in partnership with outside groups or societies. Apart from Sculpture In Context, we have worked with many other groups such as The graphic Studio, The Irish Society of Botanical Artists, ISBA, The Irish Patchwork Society, Hands Across the Border All Ireland Patchwork Society, Irish Felt Makers, Ceramic Ireland, West Cork Craft and Design Guild and many other groups. We have also shared exhibitions with the Royal Botanic Gardens, Edinburgh and National Botanic Gardens of Wales. Exhibitions are not just visual feasts, we encourage active participation from the groups to stage workshops and themed walks for all age groups enriching the quality of the visit for all and bringing in new visitors. As all of these activities are provided free of charge by the groups, neither the exhibitions nor the workshops impact on the Gardens budget.

Engaging with the Art world adds an extra dimension to the visitor profile, encouraging visitors to the gardens that might not otherwise attend. There is no doubt that partnering with these groups has increased the profile of the gardens in the media, increased visitor numbers and provided us with new opportunities to reach out and engage not only with the regular visitor but with visitors who may not normally engage with the garden.

**The Jerusalem Botanical Gardens' Hub for Social Environmental Activism – Promoting social-environmental entrepreneurship and sustainable behavior through a close knit network**

**Lior Gottesman, Adi Bar-Yoseph, Jerusalem Botanical Gardens**
Jerusalem Botanical Gardens
**Key Words**: *Social Inclusion and Community Engagement, Strategy and Future Vision For Greater Impact And Change*

The 21st century has brought with it new ways of thinking which demand new approaches to our work. People are thinking less in boxes, have stopped categorizing and separating in favor of looking at the overlaps and the meeting points creating a much more interdisciplinary outlook focusing on networks. This paradigm guides us at the JBG in our commitment to cultivating and maintaining bio-diversity and cultural diversity. It also strongly relates to the global transition where Botanical Gardens are rethinking their social role.

This interrelatedness and focus on the ever-changing connections becomes even more necessary and fascinating in a city as Jerusalem with its vast socio-economic differences and a rich cultural diversity and perhaps even fragmentation. Furthermore, Jerusalem is proving true to its heritage as a very "bottom-up" kind of place with a vibrant active entrepreneurial and civil society. In this atmosphere the Gardens are ideally positioned to create connections. They are located between seven neighborhoods of the city and within it people can get inspired by nature, relate and meet each other on this common ground. This is where our Hub comes in.

When we say "Hub" today, what comes to mind? Usually computers, a co-working space where one can get a desk, a place to work. But where does the word come from? What did it used to mean? A harbor, the centre of a wheel, a router – in a word, a central meeting place. We modeled our Hub on this original sense of the word.

**HOW WE GOT TO OUR MODEL**
The garden began doing outreach programs years ago under the Gardens' moto "*plants grow people*". We have programs for vocational training for autistic young adults, rehabilitation programs for people suffering from mental illness or for people doing community service allowing them to use their skills while serving their sentence. We have a multi-generational project in the Arab community where three generations of women and girls studied and practiced traditional uses for plants, and also have a teen green leadership program named "Green Team".

When we reached twenty one programs and had over 100 volunteers we understood this was more than just a random coincidence, but rather an actual need, with huge potential for the Gardens. Also, there was already a strong awakening of environmental activism in the city which the Gardens were not a part of we felt there is a need for a linchpin of social-environmental action in Jerusalem. We understood a Hub at the Gardens could serve as that linchpin.

We then realized we needed a mechanism that would connect all the existing programs and get them working together as well as offer a platform that will allow many more groups and organizations to meet and work with open and easy contact at the Gardens. An important aspect of this connectivity was decentralization. As a Garden, if we continued to build solely on programs developed and run by us we would inevitably reach full capacity be it at twenty, forty or even a hundred programs and so the solution was a network facilitated and

supported by the Garden, a platform upon which other groups and individuals could do their programs with greater ease. Once we knew this was what we wanted, drawing inspiration from the idea of a Hub, we had a few questions. The first was *who*?
We decided to target the professional community, those who already have their own communities and sphere of influence. In this way our potential for influence would be exponentially higher. Our focus would have to be on those with fields of interest related to the Gardens' fields of interest and expertise. We identified six areas which answered these categories: environmental social enterprises; environmental business enterprise; start-ups in agro-tech and clean-tech; environmental artists and designers; gardeners and farmers; 'green' urban planners and landscape architects. This may sound like a lot but research shows that in order to create a true force for change an interdisciplinary approach and connectivity is necessary. Once we identified our target audience the question was *how* to reach them.

The answer was simple; dialogue. In order to connect with what was happening in the field we needed to go out into it with dialogue and interviews. We built three different questionnaires for entrepreneurs at different stages and for public opinion shapers. We wanted to connect with them, hear their thoughts, so we asked about their professional lives – what they had, what they needed, who they work with, where they see themselves in five years and what they thought of the garden – but also about their personal lives to understand the context.

So after forty one cups of coffee drunk in seventeen coffee shops and four local parks I had over one hundred pages summarizing over three thousand minutes of conversation with thirty seven individuals who fit our target audiences or have key positions in Jerusalem in the socio-environmental realm; from people at the city's municipality, to the environmental government office, and from big organizations & project leaders to passionate individuals. The interesting thing of course is what people said, from which we derived our *what*. What did this community of inspirational individuals need from us?

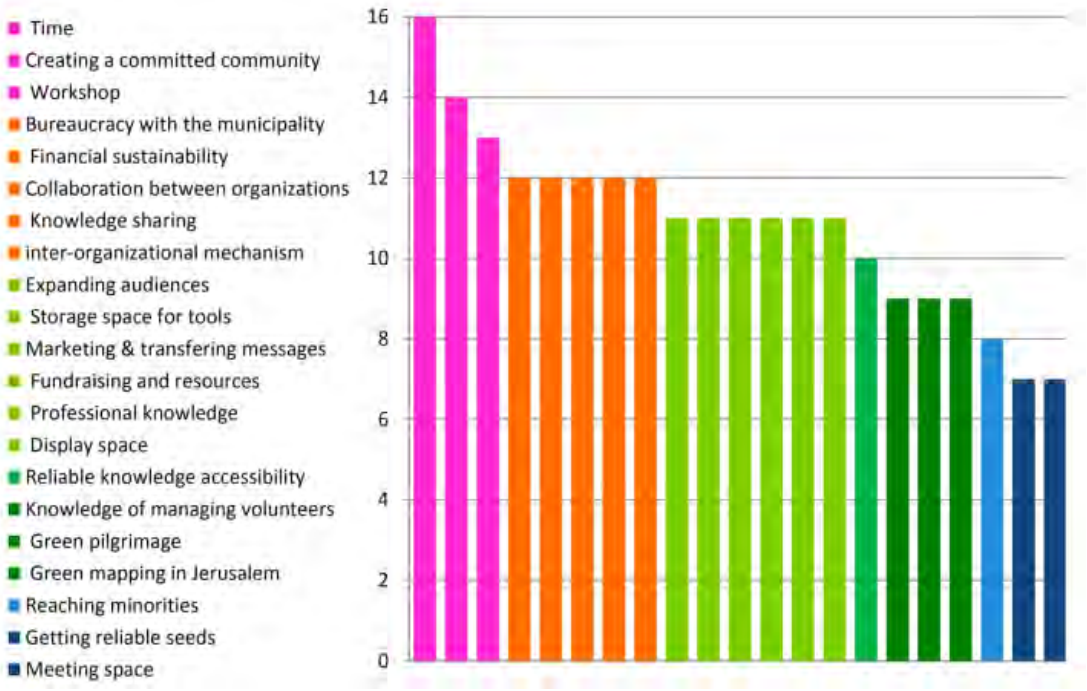
We met Adi who runs the Jerusalem food forest group; his goal is to establish three food forests in Jerusalem within a year but needs botanical knowledge to know what's best to plant, Abigail wanted a garden on every roof but needs help developing a course and a place to run it and demonstrate techniques. Dafna on the other hand just needs a space to display her environmental art as well as a more adequate space to create it than what is available and Nimrod dreams of selling his Green-Tech plant sensors start-up. He has the technological knowledge; he just needs a testing ground with someone who understands Botany. They also talked of many obstacles to achieving these goals. All this information, these dreams and aspirations had to be turned into something concrete. To do so the information was quantified. The things people said were grouped under headings or types and graded out of four in four categories:

1. Importance to the interviewee
2. Impact on the person/enterprise if that need was filled
3. Alternative sources which could fulfill that need
4. Importance to the Hub and Gardens to fulfill the need

**Table 1.** *Needs grading table. 1 being lowest and 4 highest*

| Needs | Importance | Affect | Alternative solutions | Value for the Hub |
|---|---|---|---|---|
| Expanding audiences | 3 | 3 | 1 | 4 |
| Reaching minorities | 1 | 2 | 2 | 3 |
| Bureaucracy with the municipality | 3 | 4 | 2 | 3 |
| Financial sustainability | 4 | 4 | 1 | 3 |
| Storage space for tools | 3 | 3 | 4 | 1 |
| Collaboration between organizations | 3 | 3 | 2 | 4 |
| Knowledge sharing | 3 | 2 | 3 | 4 |
| Creating a committed community | 4 | 4 | 3 | 3 |
| Marketing & transferring messages | 3 | 3 | 2 | 3 |
| inter-organizational mechanism | 2 | 3 | 3 | 4 |
| Time | 4 | 4 | 4 | 4 |
| Getting reliable seeds | 2 | 2 | 2 | 1 |
| Knowledge of managing volunteers | 2 | 3 | 2 | 2 |
| Fundraising and resources | 4 | 3 | 2 | 2 |
| Meeting space | 2 | 2 | 1 | 2 |
| Professional knowledge | 2 | 3 | 3 | 3 |
| Reliable knowledge accessibility | 2 | 2 | 3 | 3 |
| Green pilgrimage | 1 | 2 | 3 | 3 |
| Green mapping in Jerusalem | 2 | 2 | 2 | 3 |
| Workshop | 3 | 4 | 3 | 3 |
| Display space | 3 | 3 | 2 | 3 |

**Table 2.** *chart of needs according to grade*



We found that what people needed most was time. This seemingly dead-end result became operative when we started asking – time for what? Looking at the question this way opened the door to figuring out what we want to offer. People said they were wasting a lot of time (thus creating the shortage) if we could save them time that would be a very desirable service. We understood that people wasted a lot of time trying to find partners, or navigating municipal bureaucracy, looking for funding or researching various subjects necessary for their work. In this way we transformed the table into a spectrum of capacity building services and grouped them under two headings – Network and Connectivity, and Professional Development (*see figure 1*). Content driven events and an online platform will facilitate a close-knit and expanding network. Professional development encouraged through courses, consultancy sessions and open information sharing.

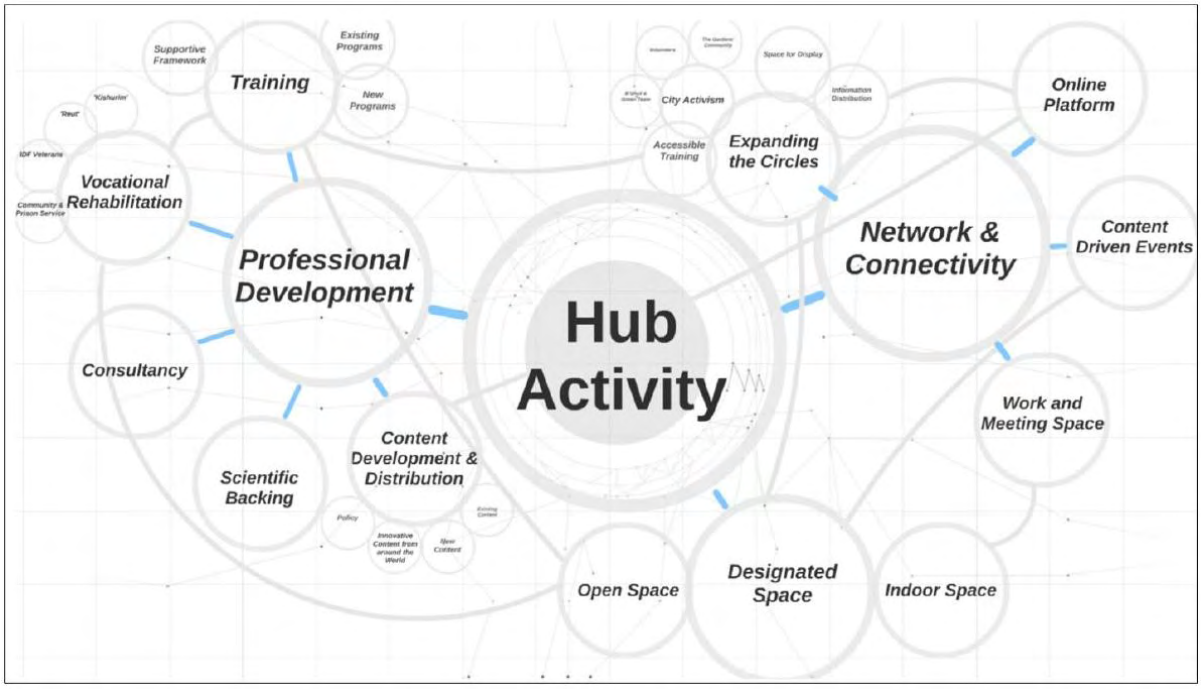



**Figure 1**. *Hub Activity map*

So Adi can receive propagation and acclimation protocols from our scientific department, train his volunteers in our training garden and then take that knowledge and volunteers with him to plant and tend his three food forests around the city. Abigail can create a course in roof gardening together with our education department and then even give it or demonstrate in the Gardens. Dafna can display her work in the gardens and perhaps give workshops to garden visitors and who knows what could happen from the meeting points between them? So the whole garden effectively becomes a Hub rather than having a Hub within the Gardens.

Our target audiences receive services from the Gardens thus enabling the JBG to promote issues which are not necessarily directly linked with its stated agenda but which do advance a joint goal of urban resilience and wellbeing. They will also meet each other and the resulting relationships within this network of interconnectedness are much stronger and can create more significant change than if we had tried to control everything and have everything go through the JBG. The Hub is the facilitator, an enabler within a flat management structure where the JBG supports but does not dictate. Perhaps it is unsurprising that this is the structure we thought of, after all, when thinking of medieval artistic depictions, Jerusalem is itself described as

a Hub.

The wonderful anthropologist and philosopher Gregory Bateson [who pioneered the idea that communication is the ever-present natural force that allows a dynamic and ever-changing understanding of meaning for living beings] said that when you look at your hand you don't see 5 fingers, but rather 4 connections. It resonates with how nature works and we think there is a lot to learn from nature in the interdependency of things. If you look at a fungi network, for example, you can see how it's not just the mushroom we see above the ground but it is the network underneath which transfers information and connects soil, trees, oxygen and much more. That is what we're trying to do at the Hub, not look at the fingers but invest in the connections, be the network underneath the mushrooms.

**Fiddleheads: a forest school in a botanic garden**

**Kit Harrington and Sarah Heller**
University of Washington Botanic Gardens' Fiddleheads Forest School
**Key words:** *Teaching and Learning, Strategy and Future Vision for Greater Impact and Change*

How does a forest school come to be in a botanic garden? The University of Washington Botanic Garden (UWBG) is a unique place, comprised of two sites– the Center for Urban Horticulture and the Washington Park Arboretum, where Fiddleheads Forest School is located. At the Arboretum the land is owned by the city so it is also a Seattle City Park. The trees and plants are owned and managed by the University of Washington. Fiddleheads Forest School is a UWBG-staffed and managed school in the Arboretum. Fiddleheads is an entirely outdoor, nature-based preschool serving 3, 4 and 5-year-olds. The School operates 11-months of the year, September through July. Children attend 2, 3 or 5-days a week. Given the complicated structure of the UWBG, creating and opening this School was not an easy feat. We came upon many challenges, but we saw them as obstacles, not barriers. To better understand how Fiddleheads came to be and the impact it is having on students and families, we share with you two perspectives on the school itself.

**OPENING OUR DOORS: SARAH'S PERSPECTIVE**

Kit and I, Sarah, came together from very different backgrounds, but from the shared place of knowing that the natural world is a compelling foundation for all kinds of learning, specifically influential in early childhood. Fiddleheads started as an idea four years ago. I had been working at the UWBG for about a year and was tasked with finding new and interesting ways of connecting with families. We had a summer camp and we had school field trips, but how else could we get families interested in the botanic gardens? I conceived the idea of a school and spent the quiet winter months composing a proposal. We submitted the proposal to the director of the UWBG, Sarah Reichard, and with her support it was passed on to the University's risk management department. And for more than a year that's where it stayed. They gave a resounding "no" to the proposal, citing safety issues, risk they didn't want to take on and that the School would be a diversion from our mission. Fundamentally we disagreed with their stance, but our hands were tied. Progress only began when our department, the School of Environmental and Forest Sciences, received a new director, Tom DeLuca, someone who had seen firsthand the benefits and success of forest kindergartens throughout Europe. He became our champion and advocate, writing to the risk management department and compelling them to move forward with our proposal. And you know what, they did. It was just a matter of us finding the right advocate for our idea. Once the conversation with risk management had been re-opened we began to sow the seeds of a healthy school. We worked closely to address their concerns – meeting licensing standards to the extent possible, securing liability insurance, identifying a safe indoor space for emergencies, maintaining a low teacher to student ratio, having clear policies and procedures pertaining to child abuse prevention, and recruiting and hiring high-quality staff. From there Kit and I built Fiddleheads Forest School from the ground up.

The road to open and smooth communication with the horticulture staff on-site has been a difficult one. The work we are doing is important and is equally as important as theirs, but often our work is at odds with their practices. One doesn't pick things in a botanical garden, but kids love to pick plants and learn from using natural materials to build and make art. So we pick lawn flowers and comb the forest floor for fallen branches. One does not climb trees in a botanic garden, but kids need to build gross motor skills so we find fallen logs and trees to balance on and jump off of. That doesn't mean there are no problems. We cannot predict what difficulties the natural world will reveal or when future difficulties in our communication with the horticulture

staff may occur. From the initial idea, to proposing our school, to opening our school and then navigating our existence within a botanic garden has not been easy, but it has been productive and meaningful. All the challenges made our idea stronger, our purpose clearer and integrity higher. We are a better school because of the challenges we overcame to open our doors.

Now that we have been open for almost two years, we have identified our other biggest, yet most rewarding challenge: to be working with our families. Attending an entirely outdoor school is definitely an adjustment and something most of our families only adapt to with time. Dressing for the weather is a big step for everyone. Three, four and five-year olds are getting to the age where they dress themselves and often quite proudly. But when they have to wear the same outer clothes day after day, the opportunity to choose their clothes themselves disappears. We have seen 'creativity' here – skirts and tutus over rain pants and a wide selection of crazy hats. Kids can be outside in just about any kind of weather and even in cold temperatures if they are dressed in warm, non-cotton layers with good rain gear on top. If they are warm and dry the weather isn't an obstacle or a detriment. Some of our most fun days are the rainiest days because we can jump in puddles, collect and pour water, create in the mud pit and sing "all the raindrops". But the nuance of what clothing is needed for what conditions takes time to learn. It might be sunny, but if it rained the night before we still need to wear rain gear so we can sit on the ground and roll down damp, grassy hills. If it is sunny at the start of the day, it could be raining by snack time, so rain gear still needs to be packed for school. A positive attitude and solid communication are keys to success.

**Figure 1:** *Student leaps into a puddle wearing all of his rain gear*

We are a school: not a program, not an enrichment, not a class. Our relationship with our families is long-term and collaborative. These families will grow up at the Botanic Gardens – they will spend two years with us at Fiddleheads, their older siblings will attend summer camp and come for school field trips, parents will take a younger sibling to family nature classes, they will donate money and supplies to our school, we will host work parties and school 'potluck' shared meals. The relationship is long-term and both the school and botanic gardens benefit from having life-long stewards of our place and the earth.

**MILO'S STORY: KIT'S PERSPECTIVE**

The following is a quote from the parent of one of our first students, a 5-year old boy named Milo:

> "It's been awesome to watch how the forest itself helps shape the educational experience for Milo over the past two years. When he first started attending he had a hard time identifying and regulating his emotions...We noticed some changes immediately after he started going to Forest School. On top of just learning about the natural world, it is wonderful to see him learn how to be more flexible about unexpected things that come his way through watching his teachers naturally adapt or, in some cases, completely change, their day's lesson plans as the forest throws new and different learning experiences at the class." –Ethan, Fiddleheads Parent

We share this with you because Milo's story is in effect the story of Fiddleheads and of the experience of living and learning in an outdoor environment. This story began in the fall of 2013, when Milo was 3 years old. When he first arrived at Fiddleheads, Milo had just moved 800 miles up the coast to Seattle. He did not yet trust that he was going to enjoy life here, much less school in our forest grove classroom, and an environment without walls invited new ways of showing that mistrust … One of them being to simply run *straight* out of the classroom and into the woods. Now, the first time one of our 3-year-olds ran out of the forest grove and down the arboretum path away from his peers and teachers, I have to admit that we were more than a *little* apprehensive about how the year was going to go.

And yet we didn't turn back; we knew it was essential for us as leaders in this space to give Milo clear and consistent boundaries. We used nylon webbing to create a visual identification of the classroom perimeter and worked with Milo, his peers, and their families to help them understand the expectations of the environment and learn language to identify their emotional state and needs. Within a month, Milo realized that staying and learning inside the classroom was a much more compelling experience than running away from it.

Clear boundaries and underlying structure provided Milo with the support he needed to become comfortable with himself and the space around him. For the first time he began to really encounter his environment, engaging with the learning and perceptual opportunities of his surroundings. The webbing came down as Milo and his peers learned to navigate their own boundaries.

As Milo became familiar and then adept at negotiating the constant gradual transition that occurs in an outdoor learning space, he developed the confidence, independence, and security that enabled him to explore outside his comfort zone. The very nature of the forest school experience encourages flexible thinking. We guide our students to take note of themselves and their surroundings. What we have found is that they in turn develop the ability to manage unexpected changes in the weather, the environment, and the day's plans. The cycle continues, each step leading into the next.

At Fiddleheads we root the learning experience in a strong foundation of self-regulation skills. Self-regulation is the motor that drives all learning on a biological, emotional, cognitive, and social level. Sarah and I agree with what many lead scientists and educators already contend: that self-regulation has the potential to influence the life-trajectory of children more than *any* other single aspect of their development. We believe that the forest school environment is far better than of an indoor classroom when it comes to developing self-regulation. To aid in this process we combine a number of specialized methods to help our students develop self-regulation and social and emotional competency.

**Figure 2:** *Students work together to view an owl pellet under the microscope*

A strong foundation of self-regulatory skills enables the children to delve deeply into the natural science and perceptual experiences offered all around them. We ground our teaching methods in experiential learning opportunities within the native matrix of plants and animals and allow students to follow their interest as far as it will take them. They learn to identify trees, sing songs about lichen, and can explain how the end of an animal's lifecycle continues to foster growth in the forest. Milo and his peers learn that everything is connected and that every element of their classroom has a story to tell. These connections and stories form the foundations of a language- and math-based approach inextricably linked to each child's experience.

**Figure 3:** *Using teamwork to balance on a wobbly log*

Transformation is intrinsic to the forest grove itself, for which change is a fundamental, incontrovertible aspect. For example, each autumn our ceiling of giant magnolia leaves cascades down to the earth, providing us with

an unobstructed view of the sky in the center of the grove. A new green carpet rolls out each spring, and as the seasons change they continually provide novel opportunities for learning and adaptation that impacts the children's experience of themselves, others, and the environment. As the students perceive, engage with and process the natural changes in their world, they in turn experience transformation on a personal level, developing confidence, independence, and self-direction.

In the forest grove, opportunities for teamwork and group problem solving are abound and transform students' relationship with their peers, furthermore student's helping one another's learning extends the education potential for both older and younger children. The students care for the forest grove because it is *their* school and they have come to know and love it as much as any other environment in their life. During their time at Fiddleheads, children grow to embrace caring for the natural world as an integral part of living on this planet, and they carry that desire to care home with them. Nearly all of our families have said that they now spend more time outdoors with their children, and that they spend that time noticing and engaging with nature.

And word is spreading. This year nearly 100 families applied to become a part of Fiddleheads. We've had more than one parent approach us with tears in their eyes, overwhelmed with relief that there is a way for their children to experience the natural world the way *they* did when they were growing up. This year, Fiddleheads will expand to create space for 49 children to attend school in the forest, and the strength of the response we are encountering in our community is a sign that it can be duplicated elsewhere.

Our goal is to continue the connection to the botanic garden and the forest into elementary schools, building relationships with kindergarten teachers and elementary educators who can foster the same passion for engaging with the natural world. We are literally starting from the ground up, sowing seeds of transformation in preschool that we hope will someday transform education for *all* students, everywhere.

**Kew Gardens as a setting for science learning: families' views**

**Naomi Haywood**
King's College London, UK

**Key WORDS:** *Teaching and Learning, Research and Evaluation*

## INTRODUCTION

Kew Gardens is a botanic garden situated in London, UK. It houses the world's largest and most comprehensive living plant collection. It focuses on scientific research, as well as being a major visitor attraction. The mission of Kew is *'to inspire and deliver science-based plant conservation worldwide, enhancing the quality of life.'* It aims to create a visitor experience that delights, intrigues and informs, as well as developing and expanding public science learning facilities.

Figure 1 below is an image from the press office at Kew Gardens. It shows a family in the Water Lily House, which was completed in 1852 specifically to showcase the giant Amazon water lily *Victoria amazonica*. It is an example of the beauty and heritage of Kew in terms of its buildings, its history and its plants. The photo has been used in publicity materials across Kew.

**Figure 1**: Image of family in Water Lily House (© The Royal Botanic Gardens, Kew)

This image can be taken to symbolise the view of families that Kew aspires towards: the family appear to be talking about the lilies in the absence of any interpretation. It may seem almost too good to be true. A question that arises is: Do families view Kew Gardens as a setting for them to learn science? This questions forms part of my PhD study and is outlined here.

**METHODS**

The methods used to address this question were interviews with 24 families and a total of 29 accompanied visits across one year. Accompanied visits are commonly used to study visitors in museums. I used accompanied visits to shadow and take part in families' visits. Parents wore a clip-on microphone so that I could record families' conversations, and I also took field notes. When I took part in the accompanied visits I had already met families on one previous occasion and over the course of the study I took part in three accompanied visits with each family. They became used to my presence, and shared thoughts with me that they would not have shared during simple interviews.

The families all had children aged 2 – 12 years (mean= 7 years), and all families had previously visited Kew, often regularly for many years. Most families had no specific interest or knowledge of science, and many families spoke about science in rather negative terms, such as describing science as '*dull*' or '*difficult*'.

**BEAUTY IN THE FOREGROUND**

Families spoke about Kew Gardens primarily as a beautiful visitor attraction, not necessarily a setting for them to learn science. Example quotes are:

- "I think of Kew Gardens as a place full of beautiful plants… "
- "Kew Gardens is one of the most amazing places in London; I really like the beautiful old greenhouses with all the exotic plants."
- "I'd characterise Kew Gardens mainly as a place with beautiful big old trees… It's a place for us to come and enjoy looking at old and pretty trees"

This characterisation positioned Kew not only as attractive but also as intellectually accessible. Intellectual accessibility here refers to families perceiving the beauty of Kew as a characteristic that they could experience regardless of their interest or knowledge about science.

Overall, there is limited interpretation for visitors as they approach major attractions at Kew, such as there being either no or only brief introductions to the glasshouses or the various areas in the Gardens. At the time of the study there was no introductory information at entrances, such as that Kew is a botanic garden or a scientific institution.

**Emotional Attachment to the Beauty at Kew Gardens**

An important theme that emerged from the study is that families had deep emotional attachments to Kew's beauty. The beauty of Kew was not just something that families mentioned in passing, but also rather something that they felt very strongly about.

Here are some quotes:

- "My son learnt to walk at Kew Gardens… It's always going to be a very special place for our family."
- "The beautiful landscape in Kew Gardens is very important to our family. It's something I'd really like the children to pick up on. I want them to appreciate the beauty as part of who we are as a family."
- "I feel really emotional about Kew Gardens. It's not just any beautiful place we visit. There are a lot of memories here, we've come for many years and I used to come with my

parents when I was a child."

Families often spoke about having personal ties to Kew, such as having visited the Gardens for many years and associating it with important family memories. Families did not talk about just visiting Kew as a beautiful place. They spoke about Kew as a special place for their families to which they had deep emotional attachments.

**SCIENCE 'BEHIND THE SCENES'**

All families were aware that Kew is a scientific organisation. Families knew that Kew conducts scientific research, they spoke about that it conducts various types of socially important scientific research. For example, families described scientific research related to the uses of plants, plant evolution and relationships amongst plants and animals, as well as plant conservation. These views reflect the research that Kew carries out as a scientific institution.

However, families referred to the science at Kew as being in the background, with its beauty being in the foreground. Most families did not fully appreciate Kew's public science agenda, they did not think of Kew as aiming to communicate science in the Gardens. Families thought of science as difficult and inaccessible to them. To sum these views up, in most families' eyes, Kew was not an obvious setting for them to learn science. Consider these quotes from families:

- "The science [at Kew Gardens] isn't something I think of, I'd assume it's difficult for us to get to grips with, certainly more difficult than appreciating the beautiful plants."

- "Clearly science is an important part of what Kew Gardens does; there is serious science behind the scenes that we don't see on visits… I'd say that beauty is in the foreground at Kew Gardens, and science is somewhere in the background."

These findings are important. Families' views of science at Kew as somewhat inaccessible suggest that families may not take up opportunities to learn science there, or may even evade such opportunities because they are not perceived as 'for their families'. When asked about science at Kew, families often mentioned taxonomic plaques. Figure 2 below is a typical plaque found in the Gardens.


**Figure 2***: Taxonomic plaque referring to the Yellow Latan Palm Latania verschaffeltii*

At Kew, as in most other botanic gardens, these plaques are commonplace. They are not necessarily intended for public consumption, but I would argue that they do represent science to visitors as they are on

public display across the Gardens.

These plaques made it clear to families that Kew is not a pretty park, but rather a botanic garden. However, families considered these plaques to be complicated, and the plaques reinforced families' views of science at Kew being 'not for them'. The plaques contributed to families' views of science at Kew being somewhat inaccessible, and of science in general being '*difficult*' and unappealing. This was because science on the plaques deemed by families to be for experts gave them the impression that science learning at Kew primarily entailed learning about botanical plant names and categorisations, to which families had limited access and everyday experience. Here are some illustrative quotes from families:

- "These plaques provide scientific information to the knowledgeable eye, but they're not useful for us to learn about plant science, there's just not enough basic information."

- "Learning science at Kew Gardens is mainly about the botanical names and codes, and how they relate to each other. The things that are written on the plaques… I'd say that science at Kew Gardens is not for our family."

- "There are plaques on all the plants that show the science name and other information… The plaques are about the science of the plants, and are useful for experts… They're not useful for me... The science there isn't something I would know how to use. To be honest it's a bit dull to me and not something I'm really interested in."

Figure 3 below shows how families described science occurring 'behind the scenes' at Kew. The photo is of an ordinary office with some science equipment that does not look very grand or exciting. It is. Overall, this perception that families had of science at Kew is at odds with the aims of Kew to provide science-learning opportunities for families across the Gardens that are enjoyable and intriguing to families.

**Figure 3**: *Scientists working in an office at Kew Gardens (© The Royal Botanic Gardens, Kew)*

**USEFUL INTERPRETATION**

Families stated that some interpretation across Kew Gardens was useful to them. All families noted labels as useful if they provided simple information on common plant names, plant origins and uses. Families described interpretation as useful if they could use it together, and if it related to their everyday experiences. All families wanted more of this kind of interpretation. Figure 4 below is an example of such interpretation.


**Figure 4**: *Interpretation label that families described as 'useful'*

**GUIDED SESSIONS**

Kew Gardens provides specific family activities, including guided sessions during which a guide from Kew talks to families about Kew's scientific work across the world. The sessions considered in this study involved a guide speaking to families next to a crate with objects and a map of the world.

Overall, after these guided sessions families described science at Kew is much more positive terms than they did beforehand. Figure 5 below illustrates how families described Kew's involvement with science following the guided sessions: it includes fieldwork in the wild, and is exciting. This is very different to the science at Kew that families previously described. Here is a quote:

> "The session showed science that's exciting and interesting to us. It seemed really like a big adventure, and something we'd love to hear more about."

**Figure 5:** *Scientists engaging in fieldwork (© The Royal Botanic Gardens, Kew)*

Families' attachment to the beauty at Kew Gardens served as a platform from which families began to think about themselves in relation to science during the guided sessions. They considered their visits to include science learning, and wanted to be seen as associated with beauty and science at Kew Gardens. They wanted other people to think of them as a family who learns science at Kew as well as appreciates its beauty. The sessions provided everyday objects (e.g., a water bottle) that made science accessible and relevant to families lives; science at Kew was no longer something abstract or 'in the background'

**CONCLUSIONS**

The study suggests that the appreciation of beauty at Kew can be a bridge towards appreciating science at Kew as relevant and interesting to families. Families can be supported in viewing Kew Gardens as a setting for them to learn science through appropriate interpretation, such as guided sessions.

**Learning about Learning in Botanical Gardens: The Importance and Value of Research and Evaluation**
**Panel session Friday 1st May**

**Dr. Joe E. Heimlich**
Principal researcher, Center of Science and Industry

Who comes to botanical gardens? Why do they come? What do they get out of a visit? How does their visit serve the environmental mission of the garden? Research and evaluation in visitor studies offers insights on these questions, and what has been learned in gardens and in other informal and free choice environmental learning sites is both exciting and challenging. What we know and what we think we know about visitors and learners in botanical gardens is not always in alignment. Even what we know is often isolated information separating the visitor from the rest of their lived experiences. There are important understandings about visitors as active participants in the garden experience serving their own intended outcomes, and how we can use those outcomes to lead visitors to the outcomes we desire. Building on Gil Penalosa's keynote, we'll explore what research tells us about how the garden visit fits within the complex learningscapes of individual lives. It is necessary for botanical gardens to engage in research and evaluation in order to help the garden, the field of botanical garden education, and the larger field of informal learning understanding the role of the garden in visitors' lives.
During the session the audience were asked to devise research and evaluation questions related to their work in botanic gardens. These questions can be found below:

**RESEARCH**

- Would tourists visit botanic gardens if they knew about them? (especially international visitors from different culture and flora)
- What are the best metrics and methods for evaluating environmental education for youth and adults
- What is the benefit of multiple visits to our garden by a) volunteers, b) young children 0-5, c) teens, etc?
- How do people benefit from a botanic garden's programme?
- What messages or concepts or media of interpretation encourage 'learning' the most?
- Why aren't certain groups visiting?
- Is the garden relevant to your community?
- Can a visit to a botanic garden connect children to nature?
- In what ways can botanic gardens contribute to societal needs?
- How can a visit to a botanic garden contribute to an educational experience?
- Are people predisposed to visiting botanic gardens if they visited as a child?
- How can botanic gardens contribute to sustainability?
- What are the key motivators for funding bodies?
- How does the results of scientific research in botanic gardens impact society?
- How do communities come to value biodiversity?
- Why might people not visit?
- Why do visitors go to your botanic garden?
- How do we document behaviour change?
- What are a communities needs and how do we meet them?
- What are the health benefits of outdoor space?
- What are the gateways to botanic garden visitation?
- What is the most important factor affecting people's environmentally friendly behaviour?
- What activities/ concepts most affect teacher's practice immediately after a professional

development workshop?
- What do visitors see while at your botanic garden?

**EVALUATION**
- Were your expectations of your visit met?
- How can we improve…?
- How can we improve the way education in botanic gardens can reach wide audiences?
- (to visitors) Did you change your mind after the visit?
- What did you get out of today's visit?
- Does our offer meet visitor's needs?
- What has changes 5 – 10 years later?
- How long do visitors view an exhibition?
- How do visitors describe their visit to their friends?
- Teach composting method: Survey participants 1 month, 1 year, years later- Are they still composting?
- What percentage of teachers in one professional development programme return to the garden for another programme? B) bring their students to the garden?

**MBG Teen Network: energizing next-generation thinkers, doers, and problem-solvers**

**Meg Hoester, Lydia Toth, Aileen Abbott, Eric Swanson and Jennifer Laquet**
Missouri Botanical Garden
**Key Words**: *Teaching and Learning, Social Inclusion and Community Engagement*

## INTRODUCTION

The Missouri Botanical Garden (MBG) team used a World Café format to discuss and share ideas about successful ways to engage and excite the next generation (teens) about environmental stewardship. The session began with an introduction that included framing ideas and questions: teens will be inheriting the environments around them—and we will need a generation of environmentally literate, conservation-minded citizens and leaders to solve problems in an ever more complex, changing world. Over the past few years, the MBG education staff have taken a step back to assess our work with teens, look at what was working, what wasn't, and gaps that existed. We are now re-framing our teen programs to see the staff, programs and participants as part of a network. On the staff side, this allows for greater collaboration and sharing of resources. Our programs benefit as we look at what works well and where we are missing opportunities. The network has allowed us to grow feeder programs that encourage younger students to become engaged with our teen programs. Our participants benefit from social, service, and adventure opportunities that allow them to meet teens from other programs and exchange ideas.

MBG staff introduced themselves and the major teen programs hosted at the Missouri Botanical Garden. The World Café format was explained—we planned to utilize three rounds of questions where audience members would get up and move to new discussion tables at the end of each round. MBG Staff facilitated discussion at each table. The first two rounds of discussion were centered on the question below. Staff at MBG illustrated the first question with practices and principles that we have found to be important, both through experience and through research over the past few years, as we've reconfigured our programs.

**ROUNDS 1 & 2—HOW DO WE BEST ENGAGE TEENS IN PLACE-BASED LEARNING THAT:**

- Develops leadership skills—empowering participants and developing leadership skills through opportunities to lead others (Deschenes *et al*., 2010)
- Connects/re-connects teens to their environment—connecting teens to their local environment while addressing challenges in the community.
- Utilizes technology effectively—engaging teens by using up-to-date technology to capture their attention and enhance learning.
- Promotes peer-learning—enabling teens to learn through teaching others
- Provides social experiences—recognizing the importance of peer-to-peer interaction among teens by building social activities into programming.
- And…? (Any major principles from audience).

**MAJOR THEMES FROM ROUND 1& 2 DISCUSSIONS:**

**General:**

- There are many fun ways to get youth involved, start with knowing their interests and grabbing their attention.
- Highlight the uniqueness of your country with place-based education
- Teaching to the World--Teen Ted Talks
- What makes it cool to be in a group?

**Incentives/Engagement:**

- It is difficult to engage teens, things that are needed include: social aspect, ownership of space, leadership opportunities, incentives, relevance to their lives, responsibility (framed as the next generation)
- As institutions, we need to consciously think about how we package experiences so that students can easily use them as a resume builder. This also allows students to better share them about the program or experience they were involved in
  - We should think of students as ”test driving” careers in Environmental Science or Education. Does this change how we frame/talk about our programs/opportunities for teens?
  - Sending research/ marketing material to schools about programs in advance may help with recruiting and enable the programs to gain traction.
  - Students respond to certificate programs and professional training opportunities if they can use in the future i.e. they are pertinent to their lives. This is where scholarship awards could be pertinent as an incentive for many different types of program.
  - What other incentives are available?
  - Uncommon to pay teens outside of U.S.
  - Programs that include student volunteers are successful in some places, but volunteering is not part of the culture in some countries
  - Gardens are great places to offer opportunities for mentoring
- School gardens as enterprises, business skills, entrepreneurship
- Creating partnerships with other institutions can lead to better engagement of teens
- Week-long summer programs work at many institutions.

**Technology:**

- Facebook is used to communicate with alumni (demographics shows teens are not using Facebook as a primary social media provider)
- Hoot Suite can be used to organize all social media. Instagram, Snap Chat, Mail Chimp (for newsletters) could be used to keep up with changing technical trends
- Just because teens migrate to technology does not mean that we should meet them only on this level. Technology can open doors but human connections are far stronger.
- Use our own methods to relate to pop culture: “what elements does a tweet need to trend what elements does a seed need to germinate or disperse?”
- Mass participation in social media but shallow engagement in programs: how do we harness social media?
- Citizen Science:
  - Students as game or app developers to create citizen science interest.
  - Geography photo-tagging through Google could be a citizen science competition/project
  - GIS Portal.

**Diversity/Outreach:**

- Have to have instructors that represent the diversity you serve
- Hiring teen alumni for garden positions leads to an increase in diversity
- Environmental Issues are important to people across all spectrums
- How do we harness/ engage the wide variety of knowledge at our institutions-> think research, communications, horticulture, etc.
- Botanical Gardens/ natural settings offer alternative learning settings for students who may not excel in the classroom.
- Ambassador Programs- Think of this as a way for young Community Leaders to engage with an institution by forming a relationship with your institution through a formal experience and then

being an informal ambassador in their community to your institution.
- Feeder programs.

**Obstacles:**
- Participation during the school year is limited with teens due to their busy schedules. Saturday afternoons are ideal for programming.
- Students struggle to learn when they do not feel comfortable/safe in their environment.
- Time and funding are often a problem; informal programs that are less structured and can still benefit teens.
- Many institutions struggle with the logistics of long-term programs due to limitations in funding and staff.

**ROUND 3—WHAT DO TEENS GAIN FROM PLACE-BASED LEARNING AND HOW DO WE MEASURE THE IMPACT?**
In what ways can we best maintain relationships/ contact with alumni?

**Major Themes From Round 3 Discussion:**
Evaluation/Connecting with/ Alumni
- Evaluation:
    - What are the long-term effects of environmental education in the teenage years on an individual's life? How can we capture/measure this?
    - Evaluation at the end of programs is important: it lets the teachers know what difference they are making and have made in students' lives and if the students' stick with environmentally conscientious mindsets.

- Alumni Relations:
    - Facebook may be best social media to use to connect to alumni
    - Connect alumni to an annual event so that they come back year after year--offer the incentive of networking and meeting new or past instructors.
    - What do we give our students when they are in our programs?

**CONCLUSION**
In general, much of the discussion focused around the ideas that teens are social, they respond to place-based education, and they are increasingly busy and under pressure to prepare for their future. They are a wonderful group to engage with—their high-energy, passion, and enthusiasm can benefit so many people and places. Programming needs to account for the fact that teens are social beings and make the best use of their social nature. Utilizing place and working in the community/ environment near your population helps to empower teens and give them a sense of ownership and purpose. Finally, with an increasingly competitive work force, teens also need to clearly see the benefit of a program experience to them, whether it is resume skill, mentoring experience, or perhaps adventure challenge that builds leadership skills.

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**Working with communities to improve wellbeing**

**Zoe Irwin, Liliana Derewnicka, Phil Pettitt, Haijia Chu, Armand Randriansolo, John Collins Onyango**
BGCI; Royal Botanic Gardens Sydney; Wuhan Botanic Garden; Missouri Botanical Garden, University Botanic Garden Maseno
**Key words**: *Social Inclusion and Community Engagement, Strategy And Future Vision For Greater Impact And Change*

## INTRODUCTION

Botanic gardens are acknowledged as centres of excellence for science, research and exploration (BGCI, 2015). Along with their scientific reputation gardens also serve a social purpose, as tranquil havens, education centres and places for outdoor adventure and discovery. Botanic gardens are treasured sites of great importance, however they are often visited by a limited demographic (BGCI, RCMC, 2011). Given their often urban location, botanic gardens can be the most accessible form of nature to their local community. Hence, botanic gardens have both a responsibility and opportunity to engage with the public. They have the responsibility to offer the public the multitude of health and social benefits that come from interacting with nature; secondly they have the chance to effectively communicate current plant and earth science. Yet this is often not appreciated by large proportions of society. How can gardens expand their social engagement? The answer may come from an emerging model being employed by botanic gardens around the world. Many gardens are looking to societal issues and social justice to galvanize engagement efforts and encourage an understanding of the environment and a dedication to plant conservation. This has been achieved by offering meaningful incentives to community groups, often those who represent so called 'hard-to-reach' audiences. The case studies outlined in the paper work to engage communities with plants, conservation and environmental issues by highlighting the ways in which they can be used to improve wellbeing.

## COMMUNITIES IN NATURE

In 2010, BGCI and the Calouste Gulbenkain Foundation commissioned a report *Redefining the role of botanic gardens: towards a new social purpose*, the first of its kind, examining the role that botanic gardens can play in tackling social issues. From this the five-year strategic programme, Communities in Nature, evolved. Its aim is to encourage and support botanic gardens to grow their social role, which means working "… in partnership with its local community on common issues of social and environmental importance"(Vergou & Willison, 2013 p.4). The programme supported six community projects, providing staff training, funding and evaluation, which were then used as case studies to form the basis of guidance for other gardens across the world on how to develop their social role (Lynch, 2015). This guidance has been in the form of publications, manuals, papers, a Community Project World Map and animation.

The most recent publication is *Caring for your community: A manual for botanic gardens*. The aim of this document was to illustrate how to develop community projects. BGCI conducted a survey about community projects. Out of the responses received, 18 exemplary cases studies were selected. It became apparent that there is no 'one size fits all' approach to designing projects that have significant social benefits for the local community. Therefore, it was decided that the manual would use case studies and analysis to highlight the various recurring themes present in successful projects of this nature (Derewnicka et al, 2015). One such example comes from The University of Oxford Botanic Garden who aimed to reach out to adults with learning disabilities.

*Growing along with the garden* was a development of work the garden had previously started catering for adults with learning difficulties. In collaboration with a specialised tutor, with whom they had previously worked, they developed a 10 week accredited course that saw attendees create their own vegetable garden and produce a portfolio of work. This gave participants practical gardening skills and a knowledge of

healthy eating; the opportunity to socialise; an understanding of work and study, skills that could potentially lead to employment and independence. As a result, participants had improved health and wellbeing. A key factor this programme highlights is the need for communication and collaboration, to create the accredited course organisers required collaboration between the garden, local council, accreditation boards, attendees and their carers to ensure the project was what the community required.

The first stage of Communities in Nature ended in 2015 and to mark this BGCI and the Calouste Gulbenkain Foundation commissioned its evaluation. The review *How can botanic gardens grow their social role: Lessons from the Communities in Nature programme* (Lynch, 2015), involved consultation with almost 130 stakeholders (BGCI staff, botanic garden members, potential partner organisations, and funding agencies), through online surveys, telephone interviews, a peer review forum in London, and an event and workshop at the BGCI 9th International Congress on Education in Botanic Gardens. The main findings suggest that BGCI needs to take the lead in encouraging work of this nature, worldwide, through a community of practice. Furthermore, there needs to be more training and buy-in at director level.

The panel delivering this session were chosen as their projects represent successful examples of the ideology behind Communities in Nature and highlight the breadth of possibilities that this way of working opens up, when it comes to enhancing conservation and wellbeing.

**PHIL PETTITT: THE COMMUNITY GREENING PROJECT**

An essential part of improving a garden's social role is to venture beyond the gardens walls. Phil Pettitt from Royal Botanic Gardens Sydney presented the *Community Greening Project*. The project functions in the deprived Bidwill area, and is based upon research indicating that low socio-economic groups most require the benefits that are gained from open spaces yet often have the least access to them (Astell-Burt et al, 2014). Royal Botanic Gardens Sydney works to create community gardens and nurseries that provide access to nature whilst improving the appearance of the area. *Community Greening,* has seen a positive effect sweep over Bidwill with citizens taking pride in the area. It has resulted in a reduction in crime, improved health, infrastructure, employment, environmental knowledge and a generally more communicative community. This has clear benefits for the wellbeing of individuals. *Community Greening* dispels the myth that botanic gardens cannot reach disengaged groups and that they are simply about the collections within their walls. In truth, they can reach out and engage with the public and make people's lives more prosperous.

**HAIJIA CHU: PLANTS THAT CLEAN THE AIR**

The next presentation came from Haijia Chu who showcased Whuhan Botanic Graden's *Plants that clean the air*. The origins of the project are a good base for many gardens to start from when developing their social role: they looked at their activities that are already popular. Air pollution is a major issue in China, so when Haijia saw a TED Talk about house plants that can clean air (Tao, 2013) an idea formed. Events that provided free seedlings and horticultural advice were already very popular, so why not adapt these to focus upon pollution fighting plants? In this way the garden is not only providing a service that benefits people's everyday health and wellbeing, they also engage them with current science related to issues that affect them directly in a format that is proven to interest them. *Plants that clean the air* is a great example of making botanic gardens more accessible to the wider public by engaging them through issues that are relevant to them. To create successful social projects it is essential to make them relevant i.e. " For social projects to work, you have to understand what the people you are trying to work with want to do and not just what you want to deliver to them." (Lynch, 2015 p.17)

**ARMAND RANDRIANSOLO: THE BLESSING BASKET PROJECT**

Armand Randrianasolo outlined how Missouri Botanical Garden became involved in *The Blessing Basket Project*. Through an established relationship with Washington University's Business school, Missouri was introduced to the project, with the idea of linking it to their site in Madagascar. The businesswomen who

developed the Blessing Baskets project agreed to work with them on a trial basis (Derewnicka, 2015). The Blessing Basket Project buys hand woven, sustainably produce, baskets from women living in poverty to sell on an international scale. Missouri Botanical Garden established communication between the businesswoman and participants and delivered training. The project has seen great success with 120 weavers trained satisfying order of up to 4,000 units, has increased local income and offered an alternative to over-exploitation of Madagascar's unique biodiversity. The involvement of the garden in The Blessing Basket Project shows how gardens can reach out to their communities to grow already established projects. In Madagascar, the Blessing Baskets Project now continues with little input from the garden and has seen significant benefits for the local communities health, income and wellbeing.

**JOHN COLLINS ONYANGO: MASENO BOTANIC GARDEN'S COMMUNITY TRAINING**

Another comparable example was heard from John Collins Onyango about the work of the University Botanic Garden of Maseno, Kenya. Citizens in the local area rely on the land for their livelihood; unfortunately most of the population are living below the poverty line which can force them to use their natural resources unsustainably. The garden has successfully engaged with the community and at the same time benefited their own research and activities. A main priority of the garden is to conserve areas of biodiversity; the local community have already been active in this by protecting several species connected to their beliefs. The university set up a programme where the locals provide seeds and knowledge to the garden and they provide sustainability and production training related to food and medicinal plants in return. This training ensures stable production and income for the community whilst benefitting the garden and its research. Both the Missouri Botanical Garden and University Botanic Garden of Maseno case studies show how gardens can get involved in communities to benefit livelihoods and wellbeing and furthermore how this can aid the gardens' work. This is an approach that BGCI and Communities in Nature is striving to encourage and support.

**LOOKING TO THE FUTURE**

As we have seen in the case studies above there are many ways in which a garden can work with its community to improve wellbeing. This can be on the basis of improving individuals' skills, prospects and employability; improving people's physical health, or increasing communities' livelihoods. As BGCI found when producing its most recent manual, the way in which gardens can improve wellbeing and their approach to project development varies widely. What is important is that gardens work in collaboration with their community to solve pressing issues of an environmental and social nature, learning from each other as they go along. With regards to Communities in Nature this is an important point for the future of the programme. According to *How can botanic gardens grow their social role? Lessons from the Communities in Nature programme*, BGCI's next step should be to develop a community of practise surrounding the social role of botanic gardens. This was an original aim of the programme, however, was not realised fully. BGCI is currently planning to assemble an online community, complemented by online training and leading to an exchange process. There is clearly a wealth of knowledge and skills related to working with communities to improve wellbeing, out there, and BGCI aims to be a catalyst for growing and spreading this further.

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**Education and Horticulture Exhibit: teamwork at Brooklyn Botanic Garden**

**Romi Ige**
Brooklyn Botanic Garden

This Pecha Kucha session focused on relationships between horticulture and education at botanic gardens. This presentation shows a small portion of a garden-wide exhibit that was coordinated with the Horticulture Department to celebrate the 100th anniversary in 2014 of the Children's Garden in Brooklyn Botanic Garden.

The main reason for this exhibit was to connect the rest of the Garden to the Children's Garden, as well as bring awareness about this important and historic education program. The Children's Garden is unique in that it is only accessible to participants who have registered for the programs and the instructors. There were also construction projects occurring around it that impeded the circulation around the area.
There were many aspects to "CG100", as we called it, but this presentation shows a series of interpretive signs that feature plants associated with the Children's Garden. Specialty gardens throughout the 52 acres that would normally grow these plants or similar ones were selected to feature these 11" x 7" (28cm x 18cm) signs. These were the Herb Garden, Shakespeare Garden, Spencer Terrace, and Annual Border in the Lily Pool Terrace. We worked with the gardener of each of these specialty gardens to coordinate the plant selection.

In the summer of 2013 the gardeners were asked to plan and propose some plants before they ordered their seeds for the next summer. The gardener of the Annual Border display was also asked to include some "fun plants" that children would find amusing. Some plants chosen were *Scorpiurus muricatus* (prickly caterpillar), and *Solanum integrifolium* (pumpkin-on-a-stick) (see figure 1).


**Figure 1**: *One of ten "fun plants" signs in the Annual Border*.

Most of the images used were from recent programs in the Children's Garden, while a few of the photos

used were from Brooklyn Botanic Garden's historic image collection (see figure 2). This collection comprises photographs taken by Louis Buhle, who documented the Garden from 1915–1968; many of the photographs show children participating in the Children's Garden program.


**Figure 2**: *A sign using a historic photo from BBG's collection.*

The text included the name of the plant and in 25 words or less, the relationship of the plant to the Children's Garden as well as a horticultural fun fact. Other signs included facts about the Children's Garden program and quotes about the benefits of outdoor and nature play for children. All of the signs were reviewed by the gardener, the staff copyeditor, and were then handwritten by the Manager of Interpretation.

The 45 signs are vinyl-wrapped sintra board ordered from a local graphic printer. The cost per sign is about $10.00 (USD) and they take 3–5 days to produce. The text was handwritten with a waterproof paint pen that can be wiped off with an alcohol based cleaner. The stakes are anodized aluminum.

**CONCLUSION**

The key to good teamwork with the Horticulture Department is early inclusion in the interpretive process. With this project, it was important for the horticulture staff to be informed of the exhibition but also the goals and desired outcomes. For this interpretive project early notice was also essential since seeds are ordered in the fall for the displays that following spring and summer. Also collaborating with the gardeners, getting their ideas and concerns is important for the overall success of the garden wide exhibition and celebration of the Children's Garden 100$^{th}$ year.

**Enlisting formal educators as partners in conservation**

**Candyce Johnson, Dena Lind and Judith Hutton**
Brooklyn Botanic Garden, The New York Botanical Garden
**Key Words:** *Professional Development, Teaching and Learning*

The Urban Advantage (UA) program in New York City is a collaboration between eight science-rich cultural institutions and the NYC Department of Education. A major component of the program, designed to support science instruction in New York City middle schools, is professional development for middle school science teachers. As a result of their partnership under this initiative, Brooklyn Botanic Garden teamed up with New York Botanical Garden to offer a new professional development opportunity for teachers returning to the UA program. This workshop introduced a model for using native plant collections at botanical gardens to learn about the impact of climate change on native plant communities and ecosystems. The participants engaged in learning activities designed to (1) deepen their understanding of current research and theories related to science education, (2) provide an introduction to phenology, (3) introduce online citizen science projects for actively collecting data on phenological events, and (4) emphasise the importance of preserving native plant communities and ecosystems.

**PHENOLOGY AT THE GARDENS**

The New York Botanical Garden (NYBG) began its phenology program in 2002. Working with partners at the National Phenology Network, the Northeast Regional Phenology Network, and Clean Air-Cool Planet, the Garden has tailored its program to match the needs of scientists who use the collected data to study various aspects of climate change. Equally important, the program enables participants to learn about and actively engage in plant biology, forest ecology and similar sciences, as well as gain an intimate knowledge of a 50-acre native forest located at NYBG. This project is actively recruiting citizen scientists and is testing curricula for school groups, teen volunteers and teacher professional development workshops.

Brooklyn Botanic Garden's (BBG) entry into phenology began in 2013, when the Project BudBurst citizen science project was integrated into some of the work the Garden was doing with teachers during professional development workshops. Teachers were asked to make regular observations of one of several specified trees, and then enter their data on the Project Budburst website. As a consequence of its collaboration with NYBG, BBG has begun developing its own materials to mirror those already established by NYBG, using the trees and shrubs in its Native Flora collection. BBG plans to continue working with teachers, both within and outside the Urban Advantage program, to encourage them to bring students to the Garden and record more data.

**THE WORKSHOP**

At the 2015 BGCI St Louis Congress Workshop participants were asked to use a scale of one to five, one meaning little to no experience and five indicating extensive experience, to indicate their level of engagement with phenology, citizen science, collaboration with other cultural institutions, and collaboration with teachers and/or formal educational institutions. Most of the participants were familiar with collaborative partnerships, including cultural institutions, in their respective areas and formal education. However, when it came to phenology and citizen science, the majority of the group had little or no experience with the topics themselves or with training others to engage in such projects.

**Citizen Science**

Our introductions provided an understanding of each organization as well as how a partnership formed between two urban gardens. A basic definition of Citizen Science was shared (source: Cornell Lab of Ornithology, which has developed and currently manages several wildlife citizen science projects such as

eBird, Nestwatch, and Celebrate Urban Birds):

> 'In North America, citizen science typically refers to research collaborations between scientists and volunteers, particularly (but not exclusively) to expand opportunities for scientific data collection and to provide access to scientific information for community members. Also known as public participation in scientific research (PPSR).
> "*Projects in which volunteers partner with scientists to answer real-world questions.*"
>
> (McEver *et al.*, 2007)

What this essentially means is that the general public is recruited to assist scientists in the greater global community to collect data about specific phenomena which would otherwise be overwhelming in time and scope to gather. No special scientific skill set or training is necessary to collect this data, thus increasing the ease and encouragement for "informal scientists" to participate. The benefits of such a partnership between researchers and the general public are two-fold: scientists receive a collection of data that would be otherwise impossible to gather, while at the same time participants in the project are inspired to learn more about the area of interest, which in turn often leads to an increase in empathy and connectedness with nature. In their review of current research, as well as in their own studies around the Great Pollinator and Earthwatch Coyote Projects in New York City, Toomey and Domroese (2013) have found that participants in citizen science projects report an increase in their appreciation and concern for nature and an inclination to protect the project's subject as well as a desire to share their knowledge and experience with others.

**Phenology**

We next moved into defining the term 'phenology.' The word 'phenology' comes from the Greek root 'phaino', meaning to show or appear, making the literal meaning of phenology 'the study of showing or appearing.' More accurately, phenologists engage in the practice of studying the timing of the changes in an organism's biology, or biological cycles related to seasonal changes within a given year. They accomplish this through regular observation and recording of life cycle phenomena (e.g., bird migration, insect larvae hatching, leaf buds bursting). In plant phenology there are generally three life events we examine: leafing, flowering, and fruiting. Each event has its own set of seasonal phenophases to record. For example, a phenologist who is studying leafing may record the dates when emerging leaves, unfolded leaves, leaves increasing in size, colored leaves, and/or falling leaves are observed.

When training teachers how to collect phenological data with their students, there are a number of things that must be considered to ensure a productive and meaningful learning experience. The first of these is what type of foundational skills the teachers and students will need in order to accurately collect the data. We've determined that before we could educate them about phenophases, teachers would need to be competent in tree morphology, tree identification, as well as the use of dichotomous keys and field guides. Once teachers feel somewhat comfortable with identifying and describing species through a botanical lens, we are then able to dig deeper into the changes occurring throughout a plant's life cycle. This is all accomplished through hands-on interaction with cuttings from our collections. BGCI Congress participants who attended our workshop received a small taste of our process when we presented freshly cut specimens, and asked them to (1) closely sketch and describe their plant part with a focus on its form and structure; (2) describe its story, or where the plant is within its annual life cycle; and (3) speculate what the specimen looked like in the phase before, and what it will look like in its next phase.

In addition to foundational skills, we have considered what supports and resources need to be in place at our institutions for teachers to easily do this work with their students. We need to be sure that the species

and specimens for which we want data are accessible as well as identifiable. We have also created explicit phenophase guides, maps, and data collection sheets to ensure accuracy in collecting the data. (See figs. 1-2) The New York Botanical Garden has already developed these materials for their established phenology program. Brooklyn Botanic Garden is in the process of developing its own materials modeled after NYBG's as result of the collaboration. Lastly, we have been very careful to present this work in the context of building scientific understanding of the natural world and its changes over time. The importance of record-keeping as evidence of climate change, the work of Aldo Leopold and his family, and an understanding of the interdependence of life cycles in nature are all large parts of the framework around which we have built the course.

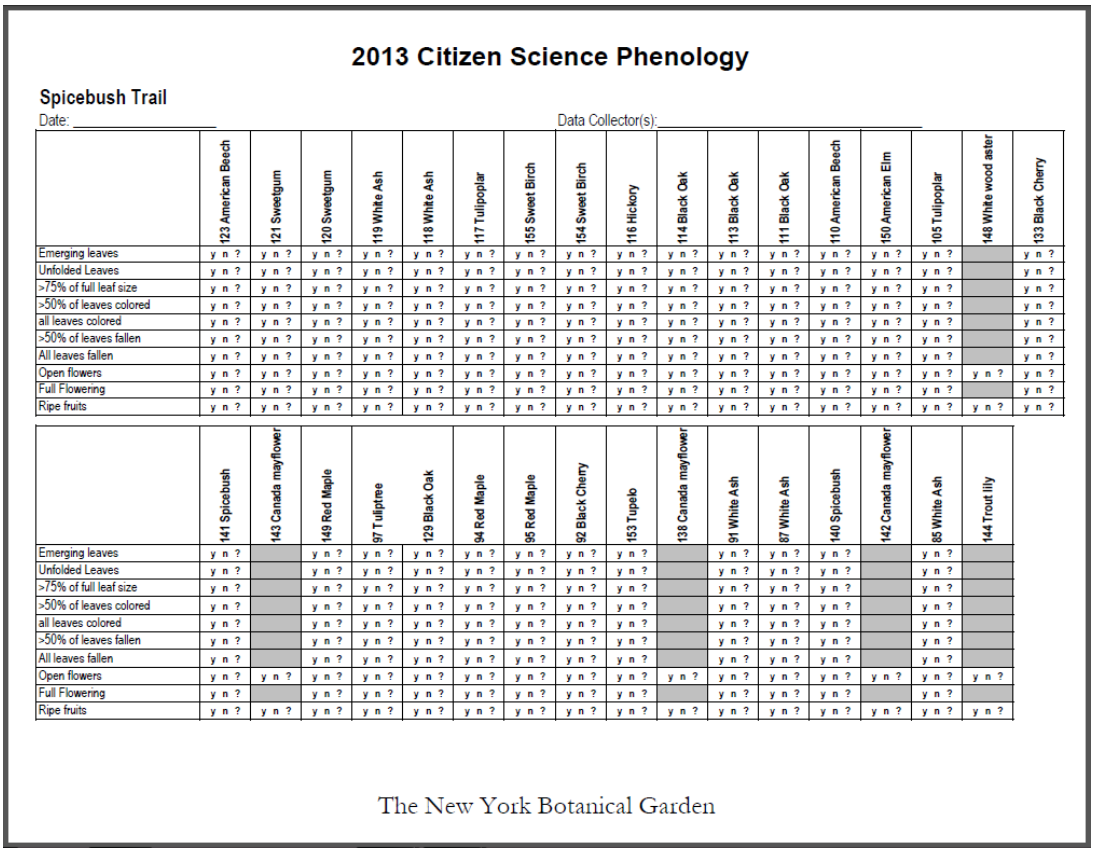
**THE DATA**

Perhaps the most difficult piece in doing this type of work is the data. Most phenology-based research is relatively new (20 years or less). In addition, citizen scientists are often volunteers or novices in the field of data collection. Because of this, citizen science data is often messy—data sets may contain gaps or they can be quite sparse. Though the concept and practice of collecting phenological data is not new, many of the accessible national databases have a limited range of data points, making definitive claims about climate difficult to conclude. As with any citizen science project, there is also the potential for the data to contain errors. Fortunately, many platforms sift through the data looking for inconsistencies that may be the result of erroneous reporting.

We have grappled with balancing the execution of sustained science investigations with this challenge related to data. How can teachers justify spending the time to collect, download, and analyze this data if solid conclusions cannot yet be determined? The answer came from a Brooklyn, New York, eighth-grade class that decided that, while "the graphs do not show a relationship between the variables … The Green Wave Northeast project (on the National Phenology Network's Nature's Notebook site) is designed to track changes in the leaf-out days in the northeast of the US. If the trees are consistently budding earlier, this could be an indication that the climate is changing. In order to get enough data, people need to continue to make and enter their observations on the Nature's Notebook website." It is commendable that eighth-grade students feel committed to continuing the project despite not finding the results they expected and recognize the importance of engaging other citizen scientists in this work. We hope that this very tangible connection to local plant communities and the larger scientific community will lead to increased student engagement and ongoing participation in citizen science phenology projects.

As the session drew to a close, participants had a lively discussion about the real objectives of promoting citizen science through phenology in our educational programming. We were left with a number of questions to consider. Isn't learning and a lifelong connection to the local environment the ultimate goal of doing this work with students and teachers? Is the goal to collect as much accurate data as possible for current scientists to employ in their research? Are we not also inspiring a subsequent generation of scientists who will pick up where our current researchers leave off? Is there an actual correlation between engaging in citizen science projects and a change in attitude and behavior towards the environment and conservation? We look forward to engaging in evaluation and possibly even research to begin to find the answers to these questions.


**Figure 1.1:** *NYBG Citizen Scientist Phenology guide to identifying phenophases in species located in Thain Family Forest.*



**2013 Citizen Science Phenology**

**Spicebush Trail**

Date: _____ Data Collector(s): _____

| | 123 American Beech | 121 Sweetgum | 120 Sweetgum | 119 White Ash | 118 White Ash | 117 Tulipoplar | 155 Sweet Birch | 154 Sweet Birch | 116 Hickory | 114 Black Oak | 113 Black Oak | 111 Black Oak | 110 American Beech | 150 American Elm | 105 Tulipoplar | 148 White wood aster | 133 Black Cherry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emerging leaves | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| Unfolded Leaves | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| >75% of full leaf size | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| >50% of leaves colored | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| all leaves colored | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| >50% of leaves fallen | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| All leaves fallen | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| Open flowers | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? |
| Full Flowering | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? |
| Ripe fruits | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? |

| | 141 Spicebush | 143 Canada mayflower | 149 Red Maple | 97 Tuliptree | 129 Black Oak | 94 Red Maple | 95 Red Maple | 92 Black Cherry | 153 Tupelo | 138 Canada mayflower | 91 White Ash | 87 White Ash | 140 Spicebush | 142 Canada mayflower | 85 White Ash | 144 Trout lily |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emerging leaves | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| Unfolded Leaves | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| >75% of full leaf size | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| >50% of leaves colored | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| all leaves colored | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| >50% of leaves fallen | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| All leaves fallen | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| Open flowers | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? |
| Full Flowering | y n ? | | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | | y n ? | y n ? | y n ? | | y n ? | |
| Ripe fruits | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? |

The New York Botanical Garden

**Figure 1.2:** *NYBG Citizen Science Phenology data recording.*

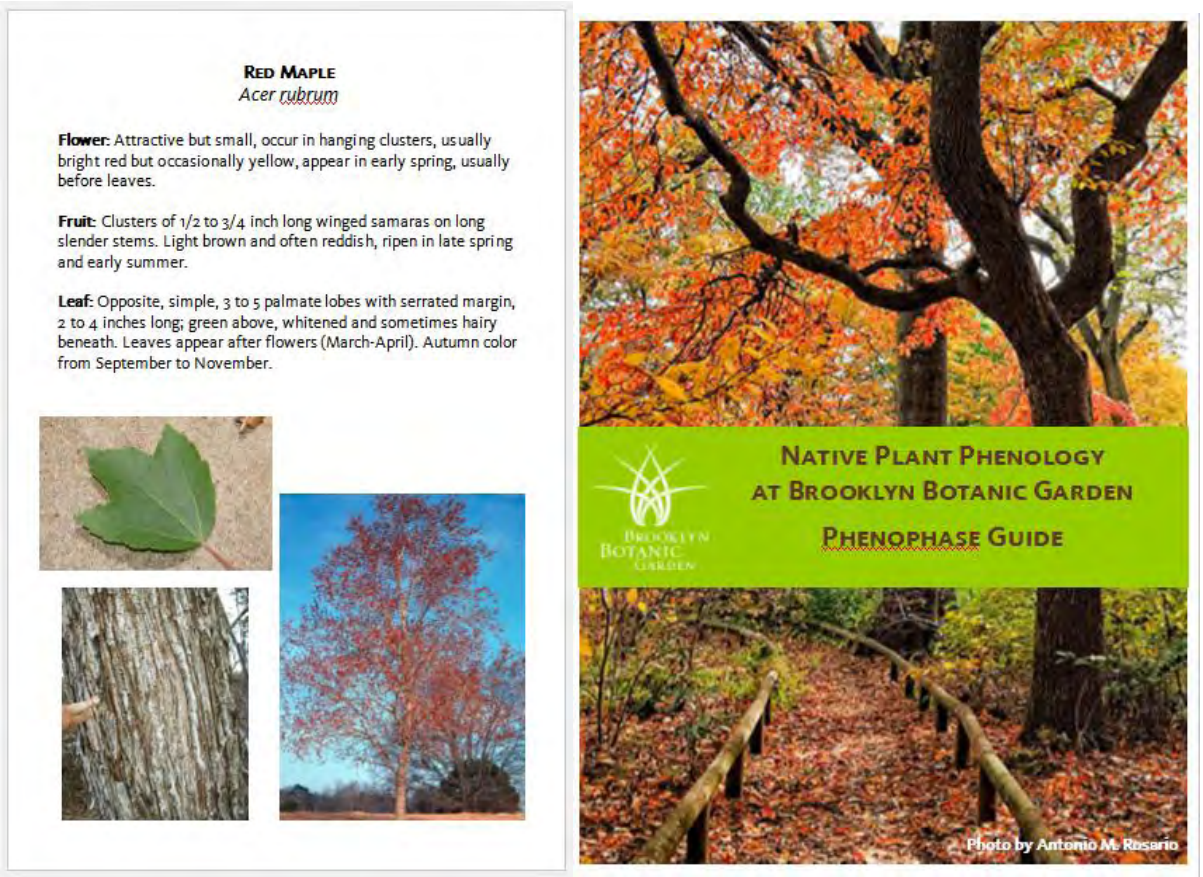
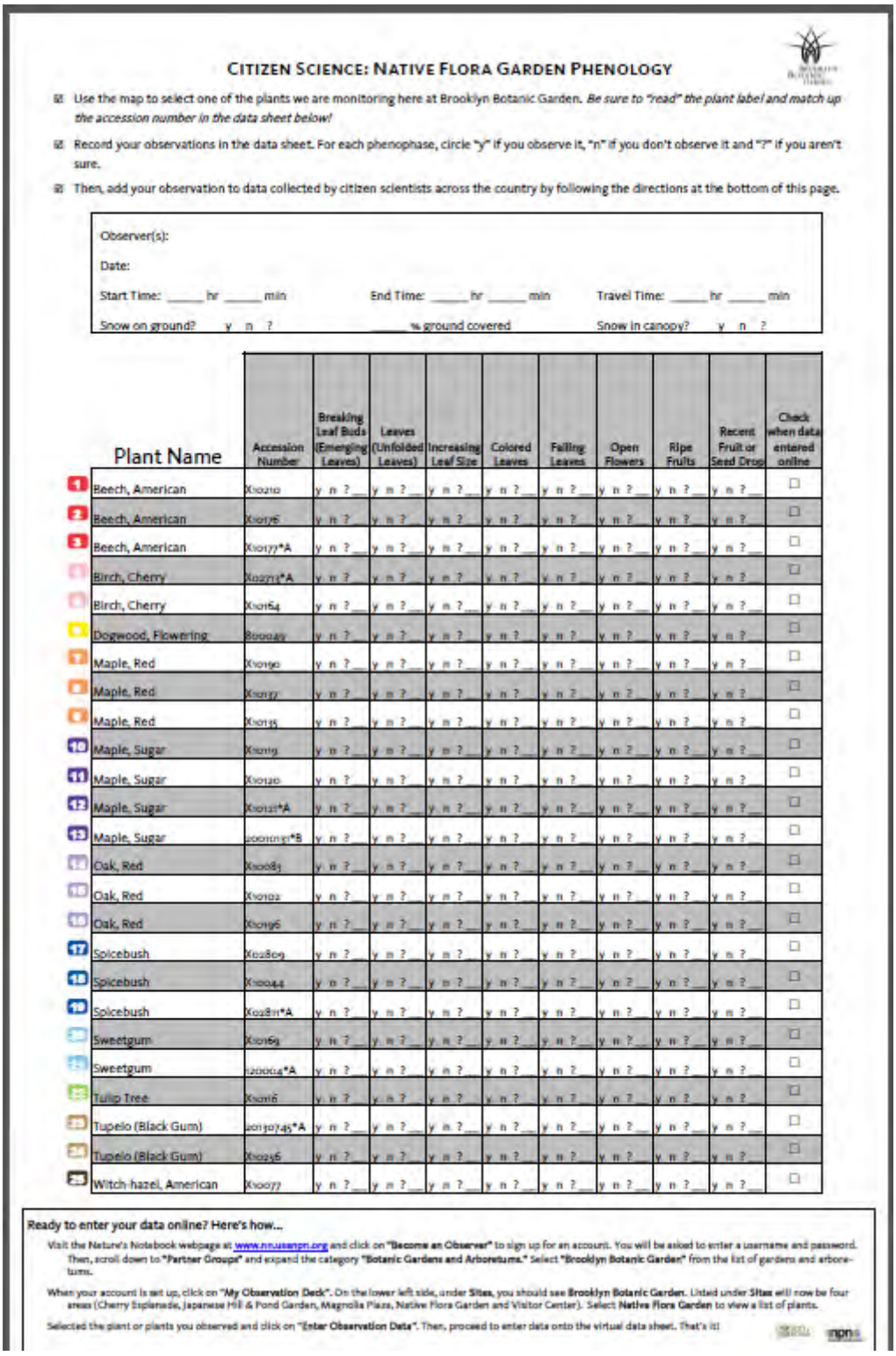



**Figure 2.1***: Brooklyn Botanic Garden Phenophase Guide. Based on materials created by NYBG, the Guide gives a brief description, timing information and photos for easy reference while out in the field.*



## CITIZEN SCIENCE: NATIVE FLORA GARDEN PHENOLOGY

- Use the map to select one of the plants we are monitoring here at Brooklyn Botanic Garden. *Be sure to "read" the plant label and match up the accession number in the data sheet below!*
- Record your observations in the data sheet. For each phenophase, circle "y" if you observe it, "n" if you don't observe it and "?" if you aren't sure.
- Then, add your observation to data collected by citizen scientists across the country by following the directions at the bottom of this page.

Observer(s):

Date:

Start Time: _____ hr _____ min  End Time: _____ hr _____ min  Travel Time: _____ hr _____ min

Snow on ground? y n ?  _____ % ground covered  Snow in canopy? y n ?

| | Plant Name | Accession Number | Breaking Leaf Buds (Emerging Leaves) | Leaves (Unfolded Leaves) | Increasing Leaf Size | Colored Leaves | Falling Leaves | Open Flowers | Ripe Fruits | Recent Fruit or Seed Drop | Check when data entered online |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Beech, American | X10210 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 2 | Beech, American | X10176 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 3 | Beech, American | X10177*A | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 4 | Birch, Cherry | X10213*A | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 5 | Birch, Cherry | X10164 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 6 | Dogwood, Flowering | [illegible] | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 7 | Maple, Red | X10190 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 8 | Maple, Red | X10137 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 9 | Maple, Red | X10135 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 10 | Maple, Sugar | X10119 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 11 | Maple, Sugar | X10120 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 12 | Maple, Sugar | X10121*A | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 13 | Maple, Sugar | 20010131*B | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 14 | Oak, Red | X10083 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 15 | Oak, Red | X10102 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 16 | Oak, Red | X10196 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 17 | Spicebush | X10280 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 18 | Spicebush | X10044 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 19 | Spicebush | X10281*A | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 20 | Sweetgum | X10169 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 21 | Sweetgum | 1200014*A | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 22 | Tulip Tree | X10116 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 23 | Tupelo (Black Gum) | 20130745*A | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 24 | Tupelo (Black Gum) | X10256 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |
| 25 | Witch-hazel, American | X10077 | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | y n ? | ☐ |

**Ready to enter your data online? Here's how...**

Visit the Nature's Notebook webpage at www.nnusanpn.org and click on **"Become an Observer"** to sign up for an account. You will be asked to enter a username and password. Then, scroll down to **"Partner Groups"** and expand the category **"Botanic Gardens and Arboretums."** Select **"Brooklyn Botanic Garden"** from the list of gardens and arboretums.

When your account is set up, click on **"My Observation Deck"**. On the lower left side, under **Sites**, you should see **Brooklyn Botanic Garden**. Listed under **Sites** will now be four areas (Cherry Esplanade, Japanese Hill & Pond Garden, Magnolia Plaza, Native Flora Garden and Visitor Center). Select **Native Flora Garden** to view a list of plants.

Selected the plant or plants you observed and click on **"Enter Observation Data"**. Then, proceed to enter data onto the virtual data sheet. That's it!

**Figure 2.2:** *Brooklyn Botanic Garden Data Collection Sheet. Each species is color-coded with a number that corresponds to locations on a map. Accession numbers are also denoted for each specimen to ensure consistency across visits.*

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**LESSONS LEARNED AT KAISANIEMI BOTANIC GARDEN – HELSINKI**
**Part of the workshop: Interpretive Master Planning at Public Gardens: Three Case Studies from Finland, Australia and the United States**

**Satu Jovero and Pertti Pehkonen**
LUOMUS Finnish Museum of Natural History, Helsinki Finland
**Key Words:** *Strategy and Future Vision for Greater Impact and Change, Research and Evaluation*

Kaisaniemi Botanic Garden (Kaisaniemi) will be going through a major restoration and face-lift in the coming years. The renewal has been planned for years but just now it is evolving from a plan into reality.

In 2012, educational curator Satu Jovero participated in the Botanical Garden Conservation International Diploma Course for Botanic Garden Education, and carried out an audience research project "*Interpretation and visitor insights into Kaisaniemi Botanic garden*" to complete her diploma. This audience research report has now been used as the most important tool and framework to support the planning process.

**WHO ARE OUR EXISTING VISITORS?**
What did we already know about our audiences? Our old visitor survey results revealed that most of our visitors were repeat visitors instead of first time visitors. According to Ballantyne *et al.* (1998) research findings, it might be likely that many of our repeat visitors are *socialisers* (who come to spend time with friends) and *escapers* (who are visiting botanic garden to get away from city life). These groups have a tendency to get engaged in non-active pursuits (such as reading, relaxing) and are not so eager to search for new information.

Designing good interpretation for repeat visitors is a demanding challenge we should seriously reflect upon. Interpretation for repeat visitors could take advantage of the seasonally changing living plant collection and point out to the repeat visitors that they will have something new to expect every time they visit the gardens. Many gardens have created seasonal or monthly trails, some have put interpretive boards at the entrance of their site on which they write on a weekly basis about the highlights in the garden.

**WHY DO THEY VISIT?**
What is their motivation for visiting the botanic garden? Do they come to relax in peace & quiet? Or to enjoy a beautiful setting? Or do they simply want to spend quality time with their family and friends?

Visitors' motivations are a complex issue and dependent on a wide range of factors, many of which are independent of demographics such as their age (Waterson & Saunders, 2012). Personal Meaning Mapping (PMM) is a visitor-centred approach for exploring visitor insights and expectations. In Kaisaniemi , participants were given a sheet of paper with a question "What do you expect from your visit today?" They were asked to write down as many words, ideas, phrases or thoughts as came to their mind related to this question. Our PMM form was based on the fulfilment maps developed for the Kew Gardens' visitor studies (Waterson, 2012).

Based on our findings the two most common motives for visiting Kaisaniemi Garden are the emotional and spiritual motivation (*Rechargers* 44 %) and intellectual motivation (*Professional/ Hobbyist* 25 %). These two motives seem to go hand in hand— even though in many cases the most important reason for visiting lies in recharging emotional batteries, the surrounding environment with elements for intellectual motivation is highly important for the overall experience.

**HOW DO VISITORS USE OUR GARDEN AT THE MOMENT?**

How do they move around and what do they do? How is the garden with its different areas being utilized? Do they visit alone or in social groups? For observing the visitor behaviour, Kaisaniemi was divided into 3 different observation areas. Our observation check list was based on a visitor observation form that was used in the visitor studies at the Westonbirt National Arboretum (England). The observation checklist included the following focuses:

- group structure (age, gender, group size)
- intention of the visit/activities seen (botany, leisure, other interests e.g. photography, bird watching)
- other observations (comments overheard, questions, movement patterns, interaction within the group etc.)

*Observations revealed that most of the visitors in Kaisaniemi moved around in pairs (46%), and that 30% of the visitors came to the botanic garden alone. Visitor age and group structure does have implications for selecting the interpretive media. Research about museum visitors by Graf (1994, in Ballantyne et al., 2007) found out that groups with children were fairly selective in their reading. They had animated discussions about the displays and were highly likely to use interactive exhibits. On the other hand, couples did not engage in conversation as much, but they did tend to read each sign comprehensively whereas people on their own focused on the texts rather than the objects or activities.*

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*The observation data reveal that the A, B and C areas differed in many aspects. In the peaceful arboretum area pairs and single visitors predominated, whereas groups were more commonly encountered in the other two areas. The most densely populated area was the service area located near the greenhouse entrance and gateways. The systematic garden seemed to attract people who were interested in investigating plants and to have the best holding power tempting people to stay there for a longer time (the least scores for 'passing' visitors and the highest scores for 'sitting' visitors). Based on these observations, it would make sense to divide the area of Kaisaniemi into different zones based on the visitor flow patterns and intensity level of interpretation needed in order to create different types of visitor experiences.*

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**GUIDELINES FOR OUR INTERPRETIVE MASTER PLAN**

Based on these findings we developed 3 major guidelines for the interpretive master plan:

**1) Better Quality Visitor Experience for Our Current Visitors**

Visitor surveys revealed that most of our visitors are repeat visitors instead of first time visitors. Based on other research findings (Ballantyne *et al.,* 1998) repeat visitors are often more likely to be engaged in non-active pursuits (such as reading, relaxing) and are not necessarily eager in seeking new information. In many cases, the most important reason for visiting Kaisaniemi lies in recharging emotional batteries. However, the surrounding environment with elements for intellectual motivation is highly important for the overall experience.

Recommendation One:

- ✓ For our current audiences, it would be worthwhile to provide more thematic information on plants, but also make sure to incorporate elements that support recharging and emotional elements (places for peaceful moments, beauty and enjoyment).
- ✓ Designing good interpretation for repeat visitors is a demanding challenge we should seriously reflect upon. If repeat visitors arrive for recharging purposes, they are often not likely to read leaflets or information panels. Ideally, the interpretive messages should be taken to them directly in person (Ballantyne *et al.,* 1998).

**2) Broadening Audiences and Targeting To New Groups**

The general perception is that botanic gardens are exclusive and elite institutions that mostly appeal to older, white and middle-class visitors. The research findings support this fact – the visitor age distribution in Kaisaniemi resemble in many ways the visitor profiles of other gardens around the world.

If we are looking for growth in visitor numbers, we should invest in actively marketing Kaisaniemi Botanic Garden to attract more first-time visitors. First-time visitors are often more activity driven and interested in interpretation and learning which would help us in attracting a more receptive audience for communicating our mission and plant conservation issues.

An interesting finding in the Kaisaniemi results was that the most important motivation category for first time visitors was the curiosity-driven *explorers*. Explorers were also often found in men and in visitors that were not accompanied with other adults (e.g. in family groups). If we are to target our messaging – not only for the existing public – but for a wider public in the future, we have to carefully think of the best ways of getting and holding their attention.

Recommendation Two:

- Kaisaniemi Botanic Garden might be able to appeal to groups more seldom seen in the gardens (i.e. first time visitors, men and families/ groups with mixed ages) by supporting sense of exploration and by including interactive elements in the garden.
- Currently, *experience seekers* and *facilitators* were clearly marginal motivation groups in Kaisaniemi. Suggesting activities for leisure families and developing materials that support the sense of exploration, might be a more efficient way of attracting facilitators and experience seekers, and thus combining interpretive efforts for several target groups at the same time.

**3) Creating Different Types of Visitor Experiences By Zoning**

The observation data revealed clear differences between customer flow patterns and activity levels in different sectors of Kaisaniemi Botanic Garden. Based on these findings it would make sense to divide the area into different zones based on the intensity level of interpretation needed. Interpretation should be organized with clear, easy to follow structures. Orientation, signage and other features such as benches need to be included in this interpretive planning process.

**Recommendation Three:**

- Establishing interpretive zones in line with visitor activity and with interpretation needs.
- Arrival zone: The service area located to the near surroundings of the greenhouse entrance and gateways could serve as an arrival zone offering information for orienting and giving an overview and general understanding about the botanic garden (orientation and information signs).
- Active zone: The systematic garden area seems to have the best holding power and could be a good place for active zone with higher interpretive contents and activity level (interpretive signs, thematic trails, illustrative activities).
- Quiet zone: The arboretum area would be optimal as a quiet zone offering opportunities for recharging (silence and solitude) and could be kept less intensive in interpretation and possibly offer more possibilities for pleasant surprises and exploration.

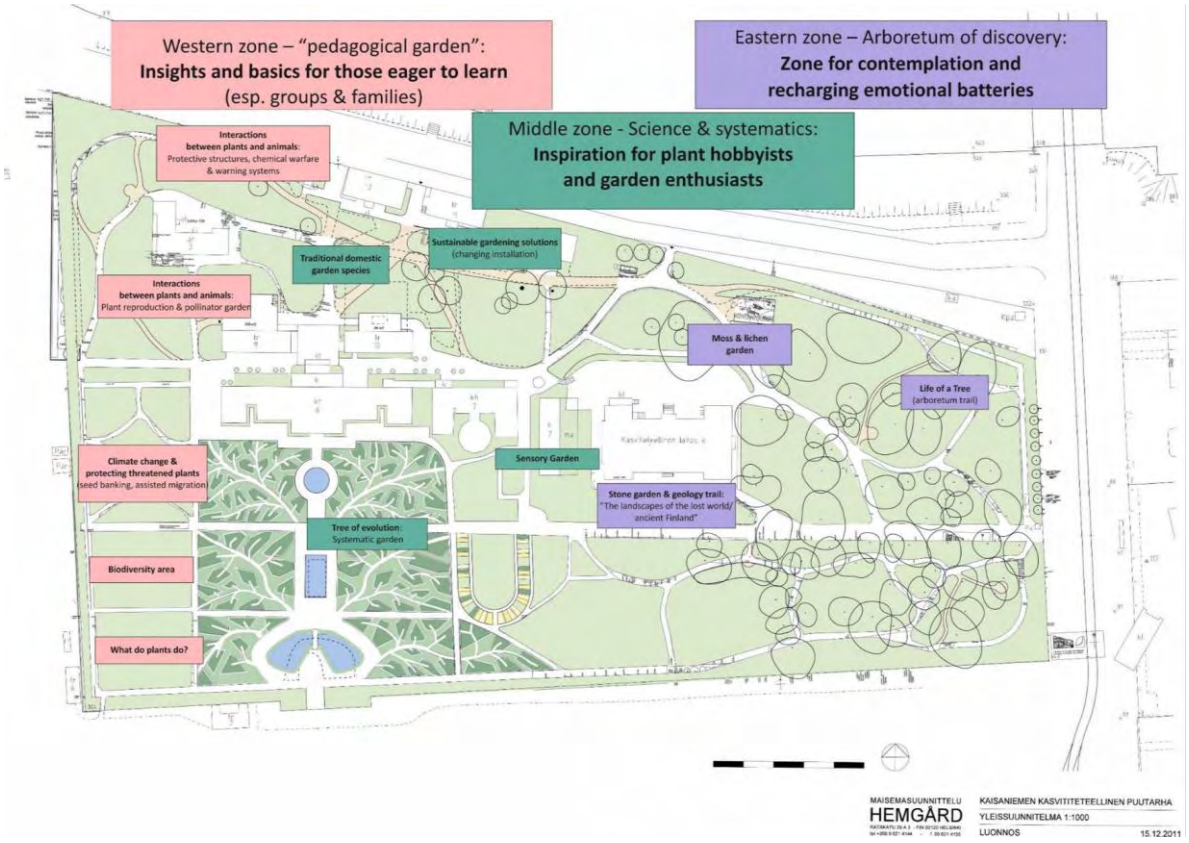


**Figure 1**: *Interpretive Plan for the Kaisaniemi Botanical Garden*

**WHAT DOES THE MASTERPLAN LOOK LIKE AT THIS POINT?**

The Kaisaniemi area has now been divided into three interpretive zones, targeted to different type of visitors and motivation categories.

1) Western zone – "Pedagogical Garden": Insights and basics for those eager to learn (especially groups & families)
2) Middle zone - Science & Systematics: Inspiration for plant hobbyists and garden enthusiasts
3) Eastern zone – Arboretum of Discovery: Zone for contemplation and recharging emotional batteries

All areas and contents in the ppedagogical master plan are striving for a common goal – helping people understand the significance of biodiversity and why it is so vital to be protected. We are looking for elements of discovery, for making the botanic garden particularly appealing for our visitors. We hope to invite people to explore Kaisaniemi and to let them experience the place by themselves. And hopefully the passion for plants is taken home with the visitors.

Our task is challenging – planning changes in historical settings, such as Kaisaniemi Botanic Garden, involve great emotions both within our visitors but also within our own institution. Hence, there is a need for a thorough discussion about the diverse issues of interpretation calling for frank and open dialogue.

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**WORKSHOP DISCUSSION**

At the end of the three presentations, the following questions were proposed for small group discussions

1. A call or question - what next for interpretation in public gardens in light of global change.
2. A discussion around the need to work across silos within our organizations in order to provide rich interpretation.
3. A further discussion how to gain internal support for the planning process and some advice on how to make change happen

**What Were The Outcomes From The Workshop?**

A number of interesting and significant questions for the future of Interpretation Master Planning in Botanic Gardens were posed by participants at the closing session of the workshop.

These were:

1. In the face of global change what are the next steps for Interpretation in a Botanic Gardens context. How are we as a community interpreting climate change – what's working in the space and what isn't? Have we established what is best practice climate change interpretation in a botanic garden and how are we measuring our impact? This is a really big question and one that we need to put on the international agenda in terms of answering.

2. We discussed the importance of collaborating early and often when developing Interpretation Master Plans. Botanic Gardens are communities that contain a number of different specialists from a number of different tribes: Botanists, ecologists, horticulturalists, landscape planners, marketing team to name just a few. As resources in Botanic Gardens are getting tighter many participants expressed the view that it is getting more difficult to work across traditional silos. Interpretation Planning can be one of those important bridge building exercises within organisations – regardless – the very best interpretation needs expertise from across a Botanic Garden in order to make it sing.

3. We discussed the importance of running curatorial processes within Botanic Gardens that support the implementation of Interpretation Master Plans after all the delivery of the Interpretation continues to have cross organisational inputs and implications.