

Roots

Botanic Gardens Conservation International Education Review

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Sowing and nurturing education programmes

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On common ground - small
community growing project
Developing alliances between
botanic gardens and universities
Bringing biodiversity to
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Raised beds at Barnes Common ©S. Morgan

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Emma Ackerley



In contrast, at Purwodadi Botanic Garden in Indonesia, their Good Education Programmes were designed strategically involving a phased roll out to ensure effective uptake by their audiences and Lancashire Wildlife Trust carefully considered how to implement forest schools and then scale up their efforts by offering training.

In what follows we look at how organisations around the world have established or are developing their public engagement. We are working under the definition that an education programme is a large-scale combination of activities. This could be the entire education offer of a site or a long-term suite of complementary projects and activities.

We have included a look at how researchers at University College London Institute of Prion Diseases, UK established a brand new engagement programme for the general public as well as how the Archa Initiative have mobilised community support to regenerate a garden in Kyrgyzstan and re-establish and reinvigorate their education offer after years of neglect. There is an example of a botanic garden in China, Xishuangbanna Tropical Botanical Garden, developing a new education programme on behalf of a school by establishing their school garden and developing related activities to highlight the garden's local conservation projects. There is also a discussion of the great potential that can be drawn from botanic gardens building partnerships with universities to develop education programmes.

Although most botanic garden educators inherit a fully functioning education programme from their predecessors, the lessons that our authors present can help us all to think about how we can build upon these, explore new avenues and establish long-lived activities that will excite visitors for years to come.

Liliana Derewnicka
Botanic Gardens Conservation International

↑ *Digging potatoes and finding worms, children enjoying the educational activities provided by the Friends of Barnes Common, Barnes, London*
©S Morgan

“To provide good learning experiences and an effective educational programme, we need to consider how, why and where learning takes place.”
(Bromley et al, 2016 p.186)

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FROM BRAIN TO GRAIN: TAKING SCIENCE OUT OF THE LAB

As scientists and public engagement coordinators at the University College London (UCL) Institute of Prion Diseases, we are passionate about developing and expanding science communication and engagement between our research staff and the public. We have developed an engagement strategy, designed and delivered a new programme of interactive activities, published our activities and established external collaborations all funded through successful external grant applications. Our focus is to widen participation in science, with non-specialists taking science out of the laboratory to diverse communities. We also aim to develop a sense of community of engagement amongst scientific staff at the institute.

↑ *Students from Rokeby School enjoying our Dirty Dopers workshop ©Jessica Sells and Cassandra Terry*

We are researching neurodegenerative diseases including Creutzfeldt Jacobs Disease (CJD) and Alzheimer's disease at the UCL Institute of Prion Diseases (<https://www.ucl.ac.uk/brain-sciences/research/research-institutes-and-divisions/ucl-institute-prion-diseases>). Our main research focuses on determining the 3D structure of specific proteins in the brain that cause neurodegeneration. These proteins for some unknown reason misfold into large aggregates and accumulate in the brain causing damage. Having both worked at various scientific institutions for many years we understand the importance of establishing communication about science



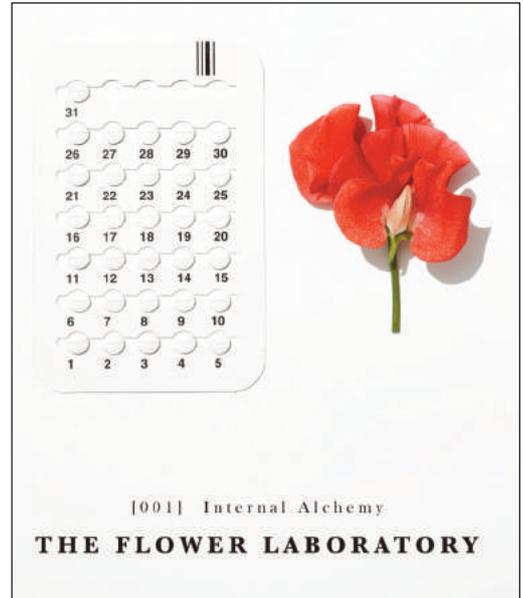


↑ Jess responding to children's science questions on film as part of science week ©Jessica Sells and Cassandra Terry

between researchers and the public, allowing greater transparency for how publicly funded grants are being spent on research and creating a mutually beneficial relationship with the non-scientific community. We have both volunteered our time to organise, design and deliver science education events at universities and museums and offering mentoring for school and university students and presented at science career fairs. Our passion and enthusiasm for engagement has grown over time and we have decided to incorporate it more prominently into our research roles.

We noticed that the majority of public engagement at our institute focused directly on patients and families at clinic open days. Whilst this is an important aspect of the institute's current public engagement remit, we recognised that science communication and education needed to expand to a wider range of audiences. To do this we formulated a plan that received support from the institute director, who understood the need for change. With no formal public engagement team we've taken on the work ourselves and used our expertise to develop a new strategy for science communication at the Institute. We based this on guidelines provided by the Medical Research Council (MRC) (<https://www.mrc.ac.uk/research/public-engagement/>) and expanded it to include audiences and communities we specifically wanted to target, and how to involve more staff in these activities and events. We started designing workshops aimed at educating children. We successfully applied for a Biochemical Society outreach grant (<https://www.biochemistry.org/Grants/ScientificOutreachGrants.aspx>), for which we designed a hands-on workshop about doping in sports aimed at children. This involved an investigation and experiment to determine whether a group of fictional athletes were guilty of using performance enhancing drugs. So far we've taken this workshop to two schools with over 200 children participating. We've written about the activity in The Biochemist blog (<http://wp.me/p8Ctqr-1hv>). We also made a film *Ask a Scientist!* where we (scientists and students at different levels of seniority from the Institute) paired up with a school and responded to any science questions children asked us (e.g. "what colour are our brains?" and "what made all the planets?"). The film we created was played during their school assembly as part of science week. We have also been collaborating with and received funding from the London School of Hygiene and Tropical Medicine for the project *Secret Agents* (#secretagents005) that we have taken to the Dagenham Youth Parade (<https://www.lbbd.gov.uk/residents/leisure-libraries-and-museums/events/annual-events/youth-parade/overview-2/>) to teach young people and their families about different infectious agents that cause disease (such as bacteria, viruses, prions), methods of appropriate treatment, and the growing concerns of antibiotic resistance, using fun and interactive games.

One of our longer term strategic goals is to reach out to local schools and communities to build a relationship with them by engaging in regular educational events and activities. To be able to deliver our activities in schools we became registered STEM ambassadors through STEMNET (<https://www.stem.org.uk/stem-ambassadors>). This provided us with training and a DBS check to allow us to safely work with children. In addition to having an array of prepared activities they require volunteers for,



↑ The Flower Laboratory created this artwork as part of the Internal Alchemy series which explores the power and use of nature in relation to our own journey ©The Flower Laboratory

Working with The Flower Laboratory is an innovative engagement method and we are in the process of developing ideas for more projects that involve unusual collaborations.



↑ Students from Rokeby School enjoying our Dirty Dopers workshop ©Jessica Sells and Cassandra Terry



↑ *Creating science-art collaborations with The Flower Laboratory: This forest was created and built in a photographic studio over the course of 4 hours for a fashion shoot for Harpers Bazaar Magazine. ©Reagan Cameron*

they also have numerous contacts that can facilitate all aspects of public engagement delivery. We have found a plethora of public engagement and communication training and networking events available through different societies and organisations including The Royal Society of Biology (<https://www.rsb.org.uk/>), Royal Society, NCCPE (<https://www.publicengagement.ac.uk/>) MRC and UCL culture (<https://www.ucl.ac.uk/culture/>) and online mailing lists such as JISCmail to share ideas, resources and contacts with other communicators doing similar work. They have all been extremely useful to aid in the planning and evaluation of our events. We have found that evaluation of activities is paramount. Public engagement should be a two-way process and feedback we have asked for, and the positivity we have received, has resulted in us continually delivering better activities. It is important to always ask ourselves what it is that we are trying to get across, what participants will be taking away from activities and events, and whether we have achieved it. Feedback we have received has demonstrated that participants better understand complex ideas through hands-on activities and have left our events with a better understanding of the relevance of the work scientists do.

We have found that collaboration is key. Interdisciplinary partnerships use individuals' differing areas of expertise to engage with audiences in multiple ways to better explain complex ideas. An example is our collaboration with The Flower Laboratory (<http://www.theflowerlaboratory.com/>) which is under development. They are an experiential design company that create botanical worlds for the fashion and film industry. They "embellish outdoor environments and create immersive experiences in photographic studios which defy belief and the preconceived use of flowers, plants and nature". They contacted us to design a workshop for their upcoming launch event. Designing experiments and activities fusing botanics and neurodegeneration has been really fun and exciting. We've created two activities; one using special glasses to alter the perception of the wearer who is then asked to complete a simple task of colouring in flower designs. This aims to raise awareness of patients with neurodegenerative diseases and how simple tasks are much more difficult when cognition is impaired. Our other activity is a hands-on experiment testing soil pH that highlights the parallels of pH balance in the brain and its importance in human and plant survival (keep an eye out for updates on The Flower Laboratory social media sites for details of where this will be held in spring 2018!). This is an innovative engagement method and we are in the process of developing ideas for more projects that involve unusual collaborations. We are happy that our hard work has been acknowledged by recently being awarded the UCL Communications Excellence Award targeted at the public (<http://www.ucl.ac.uk/news/slms/slms-news/slms/communication-is-key-2017>). As a result of this Jessica was invited to write a mini biography to feature in the UCL newsletter which has raised the profile of what we're doing even more! We are currently planning our website and social media presence and are confident that once this is established it will enable us to engage with more people and set up more multidisciplinary collaborations. All it takes is some enthusiasm and some time to put together some ideas for fun activities, and to build up a contact network of collaborators and audiences to develop worthwhile and engaging educational experiences.

"We liked experimenting. Cassie and Jess were very kind and interesting. It was fun to test the different 'urine' samples and to find out who were the dirty dopers."

Year 5 students, Rokeby School



↑ *Cassie and Jess showing off their Communications Excellence awards ©Jessica Sells and Cassandra Terry*

The Flower Laboratory create and build botanical worlds for the fashion and film industry. They embellish outdoor environments and create immersive experiences in photographic studios which defy belief. They challenge the preconceived use of flowers, plants and nature.

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REVIVING EDUCATIONAL INFRASTRUCTURE AND ACTIVITIES IN THE KYRGYZSTAN'S BOTANICAL GARDEN



The Botanical Garden in Kyrgyzstan is the biggest in Central Asia and has the richest collection of plants in the region. Together with a local NGO, the garden launched a public engagement programme and opened a resource centre where the garden employees deliver lectures and master-classes on caring for plants for the local community. After working in a closed scientific community during Soviet times, the employees of the garden now share their knowledge with people and this new community spirit has helped to revive the garden.

The centre of the Eurasia continent hosts a country named Kyrgyzstan. 94% of this, landlocked, central Asian country is covered by mountains, and its natural heritage is reflected in fruit and nut forests as well as its 300 endemic plant species. The botanic garden in central Bishkek is the only one in the country, and is located at the foothills of the Northern Tian Shan mountains. Totalling 147 hectares it remains the largest garden in Central Asia. Plants from all over the world are represented on-site.

The botanic garden in Kyrgyzstan named after the National Academy of Sciences' member Enver Gareyev was founded in 1938. In the 1960-1980s, it was recognized as one of the best on the territory of the USSR, and had the richest collection of plants, numbering thousands of species. Today, it is in an unfavourable condition. When USSR collapsed in 1991, the garden began to decline due to public funding cuts. Its displays and infrastructure are badly damaged because of a lack of labour, irrigation systems and necessary garden equipment. Despite this, the garden still continues to

↑ The QR codes are linked to the search system and allow anyone visiting the arboretum to find information on a plant label in their language ©Kaktus Media information agency

“Try not to plunge into vanity, but just breathe the air. It would seem that we are on the territory of semi-desert, but the feeling is that we are in the forest.”
Dmitry Vetoshkin,
the head of Archa Initiative

serve as the “green lungs” of Bishkek city. Through the dedication of its science staff, the garden has preserved its rich plant collection and has gained the status of a specially protected natural area. Local people provide great support to the garden, both in the form of philanthropy and volunteering. The educational activities of the garden, facilitated by a local NGO, *Archa Initiative*, has enhanced this effect and helped to revive the garden.

In January 2016, we established the Archa Initiative an NGO of local people, who dream of restoring the garden’s former glory. The inspiration was that, despite difficult times and a drastic reduction in funding for a quarter-century, the garden staff retained the integrity of the grounds and preserved all collections. To strengthen the NGO’s main program, the garden re-development based on the concept of an “Asian Mountain Garden,” we signed a MoU with the garden and became a proud member of BGCI.

As Archa Initiative we have been assisting the garden in conducting education and public engagement initiatives. Under the Soviet Union, the scientific staff was a closed scientific community working with scientists and municipal services responsible for city greening. Now, when the public are actively seeking knowledge on gardening, fruit tree pruning and advice on plant care, we have sought to satisfy this need.

We began with three strands: a) organising a platform (resources centre) for educational masterclasses and lectures for the community around a variety of topics: fruit tree pruning, use of medicinal and culinary plants, propagation and many others; b) restoring education infrastructure by establishing plant labels in the arboretum; c) volunteer recruitment to assist the garden in taking care of its extensive grounds.

As well as being a site for the masterclasses, the resource centre has gained great popularity among local people who seek advice on issues related to planting, plant protection, gardening and floriculture. “The purpose of the resource center is to enable citizens to get information about how they can improve their space, green it, the techniques to use, and so on,” said Shamil Ibragimov, head of Soros Foundation-Kyrgyzstan, when opening the centre in May 2016. Thanks to the public engagement work, a whole community of local people volunteer at the garden and contribute to its development, in particular they participate in renovating the grounds, conduct ecological activities, donate tools and funds and much more. Some volunteers provide support for preparing lectures, organizing meetings and garden activities, including plant exhibitions.



↑ *Molbulak, a local microcredit bank, plants more than 100 new trees as a gift for the spring plantings at the garden ©www.molbulak.ru*



↑ *Galina Malosieva delivers a master class on the world of coniferous plants ©Archa Initiative NGO*

“I dreamt of having plant labels in the arboretum for a long time, it shows the beauty of our arboretum.”
Galina Malosieva, a member of staff at the laboratory of woods and shrubs, responsible for the arboretum



↑ *New interpretation in the arboretum ©Archa Initiative NGO*

“I am pleased to realize that I can contribute to the landscaping and revival of the botanic garden.”
Chynara, 48, a participant of one of the renovation projects at the garden



↑ Kids reading plant labels in the arboretum © Archa Initiative NGO

Last summer, we were able to finally label the global collections within the garden's arboretum. With support from the Soros Foundation-Kyrgyzstan, the Archa Initiative and the garden developed labels in Latin, Kyrgyz and Russian. There are also information boards presenting botanical descriptions of plants and information about how and when they were added to the collection. This was something the scientific staff of the arboretum were very keen to achieve. "I dreamt of having plant labels in the arboretum for a long time, it shows the beauty of our arboretum and works which the scientists did in their lives," shared Galina Malosieva, a member of staff at the laboratory of woods and shrubs, responsible for the arboretum.

As part of the opening ceremony, the garden demonstrated its new educational components to the community. It was vital for the botanic garden to show residents its natural wealth as well as illustrate the difference between a botanic garden and a park. "Try not to plunge into vanity, but just breathe the air. It would seem that we are on the territory of semi-desert, but the feeling that we are in the forest," said Dmitry Vetoshkin, the head of Archa Initiative when talking to visitors during the event. "Only trees create such a unique microclimate in the city" he said "and the task of the botanical garden is to show it for the townspeople".

The work to involve local people in the life of the botanic garden is only possible due to the collaboration between the botanic garden and Archa Initiative. Both have been actively working to attract university students, soldiers, corporate companies and the general public to volunteer for renovation work and tree planting - which are pivotal in the garden revival.

There has also been many other initiatives developed alongside this to ensure that we reach as many people as possible and let them know about the role of the botanic garden, this has included the creation of a website, digitising of the garden library and uploading it to the website so that everyone has access. Together with the botanic garden, we launched two courses on landscape design and city greening, where the experience of the botanic garden in greening Bishkek city was passed to students of biology, biological diversity, and landscape designers.

Thanks to these public engagement initiatives launched from May 2016, the whole community of Bishkek residents has got involved with and supported the garden. These people are ready to make an important contribution to its development. This demonstrates the role of public spaces in the formation of urban culture, where every citizen is responsible for the city in which they live.

"The purpose of the resource center is to enable citizens to get information about how they can improve their space, green it, what are the techniques for this, and so on."

Shamil Ibragimov, head of Soros Foundation-Kyrgyzstan



↑ Aisha Turbatova, speaks about diversity of miniature roses and advice for their care in the resource centre © Archa Initiative NGO

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GROWING TOGETHER – COMMON GROUND AT BARNES COMMON

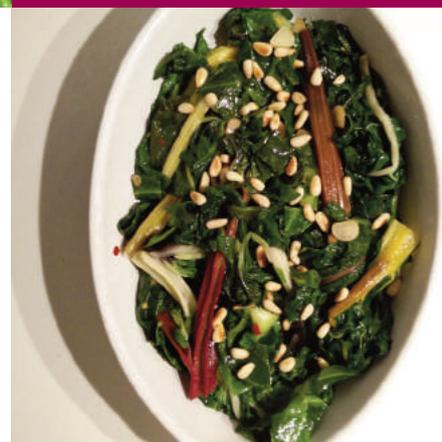
This small community growing project in South West London evolved to offer very different opportunities than we ever could have imagined. The area is finding its feet and increasingly used for formal and informal education and pure enjoyment. With my history/ heritage head, I love that this space, once a market garden/orchard, is once again a source of local growing and community.

The Friends of Barnes Common (FoBC) is a small charity that works with, and on behalf of, the London Borough of Richmond upon Thames to manage and conserve Barnes Common and Vine Road Recreation Ground, the site immediately adjacent. Prior to appointing a part-time Education Officer in May 2015, there had been popular, but limited activities. Work carried out over many years by dedicated members and volunteers provided a strong springboard. Inevitably, the role is evolving and my employer provides the support and flexibility to enable this to happen.

In October 2015, we received funding for raised beds. With the help of conservation volunteers, our first Duke of Edinburgh Award (a youth awards programme in which young people complete a series of exercises and activities such as volunteering) candidates and a local school selecting us as their 'Make a Difference Day' (MADD) charity, the site was marked out, sleepers cut, beds built and filled. Little could we imagine that those first five tiny beds would be the lynch-pin in our engagement programmes.

Adjacent to this space, a tired ornamental hedge was removed by volunteers and re-planted as an edible hedge - with elder, blackthorn, wild pear and rose, and hazel.

The 'acid grassland' bed was filled with a scrape from the common, and everything that has appeared since was in its seedbed. Our young Citizen Science groups recorded and identified indicator species, carrying out pH testing and providing robust scientific data.



↑ "I cooked a warm salad tonight with the chard and cabbage you gave me. It was delicious!" ©R. Miller
↩ Digging potatoes and finding worms ©S Morgan

Older members of the community regularly stop to get veg and to interact with our young gardeners.



This was an unusual opportunity that linked a local amenity space to a nationally scarce habitat (Lowland Acid Grassland) which is located less than 100m away, and reduces footfall on an ecologically sensitive site. Bisected by the railway, it is easily accessible for urban field studies and biology groups seeking to carry out their investigations.

In January 2015, we hosted 100 teacher-training students as part of their Geography and Maths in Outdoor Spaces module. The students experienced creating sessions within an amenity space and could also contrast this with the 'wilder' open space on the common. This led to school visits conducted by newly qualified teachers who had taken part and an invitation to speak at the 2017 Geographical Association Conference on *Common Place, Common Sense* that championed the benefits of off-site outdoor learning and developed links with other universities for teacher training and research opportunities.

Where we once only welcomed casual 'drop-in' sessions we now offer regular sessions that, due to demand, require booking in half-termly blocks. *Little Sprouts*, for example, is a weekly gardening session for under-fives and their guardian adults. We also have an after-school Art and Science club aimed at KS2. Regular weekly participation has highlighted how even the very youngest and most reticent children quickly become more at ease with open spaces. Even the tiniest fingers take care and are more mindful when handling plants and creatures – worms are a definite favourite! With never less than four languages on the go, sessions are lively, active, and inter-active. An added bonus for all is learning new words for our plants and animals!

Off our Trolley runs alongside *Little Sprouts*. Weekly produce is harvested and available to anyone passing or shared within the group. There is no charge, but many people offer donations. Older members of the community regularly stop to get vegetables and to interact with our young gardeners.

A surprise off-shoot has been receiving photos from many people keen to share recipes and show-off the food they have prepared with our produce. This year, our *Great Community Pumpkin Challenge* invites people to receive a large piece of our pumpkins when they are harvested, to cook and share with family and friends, and then to share photos and recipes with us. Both ideas evolved spontaneously, driven by community involvement and feedback. We are excited to bring this all together with an *Off the Vine* recipe book/calendar.

← Ideas, programmes and community engagement have all emerged from our first few raised beds ©S Payne and S Morgan



↑ Muddy play followed by making scented footbath bombs. *Let's Play Dirty* is one of our most sensory and popular holiday programmes ©S Morgan

Regular weekly participation has highlighted how even the very youngest, most reticent children quickly become more at ease with open spaces. Even the tiniest fingers take care and are more mindful when handling plants and creatures.



↑ Total focus and gentle fascination from one of our *Little Sprouts* as she explores a very wriggly worm ©S Morgan

Perhaps one of the greatest outcomes of our formal learning programme has been the progressive development of our relationship with a local Special Educational Needs (SEN) senior school with limited access to outdoor space. Following initial contact with the head teacher, we began weekly nature walks for a group of non-verbal students and their inspirational teacher. Identifying a need and working on her recommendations, volunteers and Duke of Edinburgh candidates cleared paths through woodland to facilitate a series of sensory environments. Tributary paths were also cleared to enable anyone to be able to return to school without re-tracing their steps. It took nearly an entire term, but there was such a huge sense of achievement when one day each and every member of the SEN group completed our entire circuit. Other classes attend *Seasons and Weather*, visiting once each term to record colours, clothing and weather before making a prediction about the season...not always easy when it is snowing in Spring!

From September 2017, we are delighted to be working with the school on a weekly basis. This will provide regular contact time on the common or at the raised beds as part of their science, environment and citizenship curricula. We also look forward to welcoming two post-16 students interested in carrying out gardening and food-growing work experience.

The increasing demands and popularity of the projects highlight a strong need for a defined and sheltered growing space. We have recently submitted planning permission for a polytunnel, and hope for a positive outcome that will, once again, take us down new paths and bring new experiences.

Any venture faces challenges. To date these have been far outweighed by the benefits, but are nevertheless significant. Issues facing us include theft and damage to produce, dogs in the growing space and handling the 'open-all-hours' nature of the amenity space. We aim to take little steps and work hard to keep our website, social media, and on-site notice boards up to date and informative. We have a high presence out and about, chat to absolutely everyone, regularly share produce, encourage every part of the community to become involved – and smile lots!

As with all things organic, the project evolved to offer very different opportunities than we ever could have imagined. The area is finding its feet and is increasingly used for formal and informal education as well as as a recreational space.

It is exciting to see a number of research papers acknowledging national differences in social attitudes, pedagogy and policy, and how this is affecting changes worldwide. Fjørtoft's Norwegian research argues "children's development is a joint function of the person and the environment (Malone and Waite 2016 p.23). Similarly, In 2013, the new Danish Curriculum introduced a longer school day (08.00 to 14.30 – 15.00) to enable time for "open school", incorporating surrounding community, museums and parks in a teaching context. Singapore's Ministry of Education is also drawing on international evidence and practice from the UK, Denmark, Germany and Australia, to frame their outdoor education master plan. In the UK, whilst there is increasing recognition of the benefits of closer collaboration between outdoor learning providers, researchers and schools, there is a view that further quantitative evidence is vital (Malone and Waite: 27). Being just one of an increasing number of small community growing and engagement groups, we are often the first point of contact with local spaces. We welcome the increasing recognition of the benefits of collaboration with larger more established learning providers and feel there is so much to be gained on both sides, and most importantly, by those taking part.



↑ Great maths session for a hot day – pot washing, then sorting by size, shape and colour – and lots of clean pots! ©S Morgan

As just one of an increasing number of small community growing and engagement groups, we are often the first point of contact with local spaces. We welcome the increasing recognition of the benefits of collaboration with larger more established learning providers and feel there is so much to be gained on both sides, and most importantly, by those taking part.

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SCHOOL GARDEN AND HOLY HILL XISHUANGBANNA, CHINA

The school garden project was started in 2014 and finished in 2016, as an environmental education component of Xishuangbanna Tropical Botanical Garden's (XTBG) Zero Extinction project. XTBG helped design and build the garden throughout the two years. Afterwards, XTBG has also been assisting in organizing the school's environmental education activities in the school garden, and in getting students involved in a project that aims to reforest the Holy Hill, which is culturally significant to the Dai People, a local ethnic group.

↑ The Holy Hill near Manyanguang Village in Xishuangbanna ©Liu Jingxin

Xishuangbanna, in tropical southwest China, supports more than 10% of China's total vascular plant flora in 0.2% of the land area. Rapid expansion of cash crops in recent decades has reduced the forest cover in many areas to scattered fragments. (Xu and Grumbine, 2012)

BACKGROUND

Xishuangbanna, in tropical southwest China, supports more than 10% of China's total vascular plant flora in 0.2% of the land area. Rapid expansion of cash crops in recent decades has reduced the forest cover in many areas to scattered fragments (Xu and Grumbine, 2012). Some natural tropical rainforest remnants are conserved on the *Holy Hills*, as called by the Dai people, of local villages. One of these Holy Hills is near Manyanguan village. Its forest remnant was part of a larger forest area until the 1950s. Although the remnant is considered to be a Holy Hill by the local Dai people, it has been gradually reduced to 13.85 ha (Zhu *et al.* 2010). The forest has also been degraded by cutting of timber and other plants.

The remnant was floristically inventoried in 1959/1960, 1997 and 2008. Although the forest area has shrunk, the number of species in the remnant has remained similar. However, the number, reduced by the loss of many shade-tolerant primary forest species, has been compensated by the addition of pioneers and ruderal species, including several aliens (Zhu *et al.* 2010). The structural changes since the first survey are also dramatic, with the loss of most large trees, creating many gaps in the canopy. The remnant is now almost completely surrounded by rubber monocultures, but local Dai villagers' respect for their Holy Hill and the remnant's historical and scientific importance has ensured that a core area remains more or less intact.

In 2013, under the financial support of BGCI, XTBG partnered with the Management Bureau of Xishuangbanna National Nature Reserve (XNNR), Jinghong Forest Station and Manyanguan primary school for a project that includes a new vascular flora survey, forest restoration and public education. This article will focus on education and restoration aspects, both of which are reflected in a school garden project in Manyanguan primary school.

SCHOOL GARDEN PROJECT

In 2014, XTBG started a school garden project in Manyanguan primary school, as an environmental education component of its Zero Extinction project. The primary school was founded in 1958. The majority of its students are from nearby ethnic groups, including Dai, Hani, Lahu, Bulang and some international students from Myanmar. XTBG helped design and build the garden over two years, while ensuring the involvement of the school's students, e.g. they drew out their vision and preferred design and layout for the garden. Building of the school garden project was completed in 2016. The garden covers an area of 700m², consisting of four collections:



In 2013, under the financial support of BGCI, XTBG partnered with XNNR, Jinghong Forest Station and Manyanguan primary school for a project that includes a new vascular flora survey, forest restoration and public education.



↑ Manyanguan primary school students planting trees on the Holy Hill ©Duan Qiwu

In 2014, XTBG started a school garden project in Manyanguan primary school, as an environmental education component of its “Zero Extinction” project.

← Manyanguan primary school students presenting the plants in their school garden. “Those purple flowers smell like garlic”, they said ©Qiu Wenhui



1) plants for forest restoration, including large tree species and shade-tolerant species; 2) plants relevant to ethnic culture, e.g. food, medicine and religion; 3) lianas, 4) other plants, with a focus on those that have distinct adaptation skills in the tropical environment, in order to stimulate students' curiosity of further exploration in ecology.

While the garden was finished in 2016, educational activities in and relevant to the garden are on-going. Within the activities XTBG's environmental educators help the school organize, there has been a focus on plants that are culturally important to local ethnic groups, and on plants that are used for forest restoration in the rainforest remnant where the Holy Hill is located.

Students not only use a sensory approach to get to know the plants, they also learn how to grow them from seed and cuttings and are guided to understand the deeper meaning of the plants in terms of ethnobotany. It is crucial that the younger generation, by recognizing plants' significance in their culture, by learning to take care of their school garden, and by establishing personal connections with plants and earth, understand the deep rooted relationship between plants and their cultural heritage. Realizing the impact on their environment and cultures brought by cash crops like rubber trees and bananas, which have dominated the landscape they are now familiar with but which is now extremely different from what their parents and grandparents used to see and live in.

For the forest restoration aspect, XTBG and Manyanguang primary school co-organize educational activities for students to learn about iconic species for their local rainforest, including the large trees that disappeared in the Holy Hill forest remnant. The activities began with students' assistance in setting up interpretation signs and hanging species IDs for the young plants in their school garden, followed by observation and keeping journals about the plants in the garden. Then, the school organised for the students to visit XTBG, where tall and large tropical trees are well conserved, and where the students can see what the young trees in their garden may look like one day. Next, guided by a local Dai ranger employed by XTBG to take care of the Holy Hill forest remnant, students visited the Holy Hill, learnt about the dramatic changes happening to the forest in the last few decades and the consequences which are noticeable under the current forest canopy. Finally, XTBG prepared seedlings of local tropical large tree species for the students to plant in the Holy Hill forest remnant, as part of the forest restoration effort.

With multiple parties in collaboration, cultural and ecological aspects in interaction, and different generations in communication, an environmental education model based upon the school garden is taking shape, and will continue to influence local students in (and hopefully beyond) Manyanguang primary school in Xishuangbanna.

↑ *Manyanguang primary school students visiting XTBG, including its ethnic culture museum and preserved rainforest where tall and large tropical trees still stand ©Qiu Wenhui*

While the garden was finished in 2016, educational activities in and relevant to the garden are on-going... there has been a focus on the plants that are culturally important to local ethnic groups, and on plants for forest restoration...

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BRINGING BIODIVERSITY INTO THE HANDS OF NEW GENERATIONS WITH PERMACULTURE



Achieving the Sustainable Development Goals depends heavily on biodiversity conservation and ecological restoration. Botanic gardens are now mobilizing to integrate systems and bring science to new audiences. Malva Permaculture Farm offers rich fauna and flora for natural sciences education outside the classroom. Aiming primarily at reconnecting people to nature, the education programme at Malva Permaculture Farm incorporates ecology theory from an academic perspective as well as permaculture farming practices. Inspiring, hands-on, creative experiences make nature relevant and lead to transformational commitment. Natural events such as migrating storks staying overnight or fireflies help to inspire the public and change their perceptions of the world around them.

With ever increasing intertwined environmental and social problems and fewer students to study science at higher levels of education and as a career, classroom and laboratory based schooling will not suffice. The targets and the quality of the education system should be rethought and adapted to meet the learning needs of younger generations. Two thirds of the planet's land is being used by humans. It is the feeling of separation; the loss of our inter-connectedness that has led to the over-exploitation of Earth's resources. By protecting, introducing and enhancing biodiversity through permaculture practices, we aim to provide a doorway back to nature. This, we believe, will awaken the visitors' wisdom and self-love; understanding that they are an innate part of nature in the hope that they will transfer this into their everyday routine. This recognition, mediated through outdoor learning sites, could encourage a better way of life where respect for self is respect for nature. Only through our own reflection, may we hear the language of the trees and plants that we have long forgotten.

✦ *Finding the "real treasures" ©Melike Muezzinoglu*



Using Aichi Targets and the Sustainable Development Goals (SDGs) as a guide, botanic gardens are redefining themselves with a vision of incorporating food systems to help combat habitat loss and support widespread knowledge to slow climate change.

Malva Permaculture Farm is a 130-acre, organically certified, experimental farm (70km away from the city centre of Istanbul, Turkey). It has been a member of BGCI since March 2017. It was established in 1983 as an ecological restoration project. It has a rich fauna and flora with the main produce being fruit, vegetables, aromatic and medicinal herbs. One may observe the wild bees, geese, native birds, bats and many migrating bird species including the white stork that stay overnight during autumn. Its founder and current curator has the mission to preserve, introduce and enhance biodiversity and enable humanity's reconnection with nature. Through Malva's setting and resources, we aim to be a hub where the natural world is presented and can be experienced through fieldtrips and activities.

OUR MISSION

As an organic botanic garden/farm, we aim to address the society's big issues by collaborating on research, conservation, sustainable farming, education, and capacity building for public engagement.

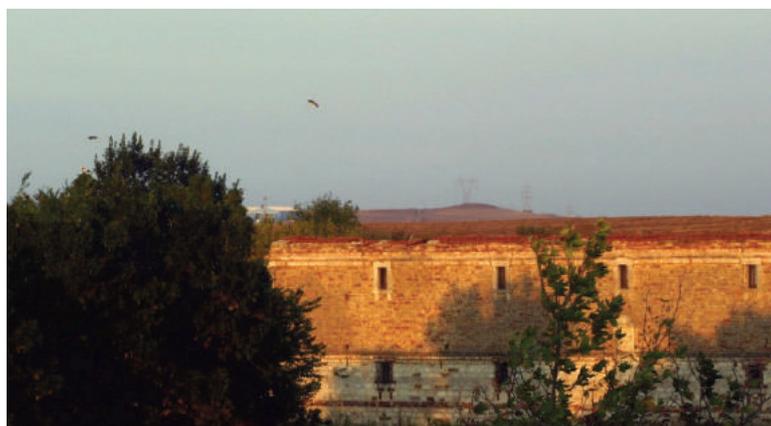
To achieve the Aichi Targets and SDGs, it is evident that there is an ever-increasing need to connect people with nature. According to Chawla's research, of those who do grow up to devote themselves to the protection of the environment, the study of nature, or some other related field, 77% identified one of two factors that led them to their field; either they had positive childhood experiences that inspired their life's work, or a family role model demonstrated a love of nature and passed this passion to them (Chawla, 2002).

OUR VISION

What we do in the next 10-20 years will determine how much wilderness will be left. Environmental education; science education and plant related knowledge need to be communicated through nature, our best teacher. Being a Soil Protector Farm as a reconnecting medium, we believe in provocation by:

- a) Scientific thinking in dealing with daily life.
- b) Teaching knowledge and skills.
- c) Science as a career pursuit.

As the Turkish evolutionary biologist Prof. Ali Demirsoy, states: "To teach; you have to provide one-to-one learning".



*All the World's Problems
Can Be Solved in a Garden.*

Geoff Lawton

*As an organic botanic garden/farm,
we aim to address the society's big
issues by collaborating on research,
conservation, sustainable farming,
education, and capacity building for
public engagement.*



↑ *Introduce; preserve; enhance biodiversity through
permaculture practices ©Malva Permaculture Farm*

*By protecting, introducing and
enhancing biodiversity through
permaculture practices, we aim to
provide a doorway back to nature.*

← *The 150 year-old farm offers rich biodiversity
©Melike Muezzinoglu*



← Students search for the genetic variance of a medicinal plant, *Calendula officinalis*, by looking at the formation of its petals and the differences in the amount of total carotenoids ©Melike Muezzinoglu

The Aichi Targets relevant to our mission are;

Target 2:

Practice and promote sustainable agriculture

Target 4:

Sustainable consumption and production

Target 7:

Promote sustainable agriculture

Target 11:

Protected areas increased and improved

Target 14:

Ecosystems services

Target 15:

Protecting life on land

Relevant Sustainable Development Goals (SDG) and Relevant Indicators that we incorporate at Malva Permaculture botanic garden/farm are:

- **Goal 1. Controlling over the degradation of soil:** eco-restoration schemes as remedy for deforestation via the applied agroforestry project.
- **Goal 2. Generating sustainable food production systems:** maintaining genetic diversity of seeds and cultivated plants- by using non-GMO local and certified organic seeds as a farmer.
- **Goal 3. Ensure healthy lives and promote wellbeing for all at all ages:** enhancing the ecosystem and the medicinal herbs garden.
- **Goal 4. Quality education:** teaching about the importance of plants at and outside the botanic garden/farm.
- **Goal 6. Protect and restore water-related ecosystems, preserve the underground water by rain harvesting and mulching.**
- **Goal 13. Climate action** through a planned collaborative scheme, improving awareness through arts and music.
- **Goal 15. Protect, restore and promote sustainable use of ecosystems, sustainability manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.** Permaculture is key to enhance life on land.
- **Goal 17. Partnership** with NGOs; national and international Institutions on support, scientific research, knowledge sharing and application

OUR CHALLENGES

From a societal and educational perspective: aptitude in maths and sciences are the key measures for problem solving however, the exam results of Turkey's young people in maths and the sciences have been plummeting, informal education is rather constrained and there is no space for life-long learning experience or observation. As for financial challenges, we are entirely self-funding at the present moment.

ACHIEVEMENTS

Education: In order to realise our mission, in May 2017, Malva Permaculture Farm decided to expand its area of impact, and started being more active on social media. It was added to the national Eco-Map/Eko-Harita (ekoharita.org), which is a web based multi-functional portal containing ecological settlements, eco-farms, botanic gardens, urban gardens, etc. A teacher reached us through this eco portal and a day visit for 10th graders to complement their science programme was organised. This led to the development of the core education programme. The structure of the visit was in three parts;

- 1) the first session was theory based which is complementary to the visiting year's curriculum;
- 2) the second session was based on hands-on, real-life experience with application in the field. Selected medicinal plants or vegetable seedlings, based on what was seasonally appropriate, were planted, with each student taking an active part;
- 3) the third session concentrated on native (medicinal and aromatic) plants with a workshop on sample collection for herbaria.

To finish the day, the students were asked to label their samples with Latin and Turkish names and tasked to develop a herbarium display back at their school. The visit proved to be successful by gaining much appreciation from the science teachers; the Head Teacher sent very positive feedback by calling this; "the most meaningful of all visits".

BREAKING DOWN BARRIERS AND WIDENING AUDIENCES

Deciding to open to the public, having an online presence and being featured at ecologic portals, volunteering to work with NGOs, selling at community supported groups and learning each day has helped us to expand. It is a noble thing to be a producer and it's amazing how many people are attracted to come and visit just because we feature what we produce on social media. Many come for repeat visits and many offer to volunteer; this has enabled us to grow and diversify our educational activities.

The development of our education programme has largely come from local demand, established through catering to a local school and expanded upon request from an international NGO's local branch. At their behest we designed a seasonal women's education and empowerment workshop. This involved collecting seasonal native plants and making syrups and a community building - nature reconnection session in the open air. We have turned these first workshops into a seasonal running programme.

In addition to the school visits and community workshops we have delivered teachers' workshops and family days for families with young children. The story does not end here. We have already programmed education activities that will span the coming years.

UPCOMING EDUCATIONAL PROGRAMME

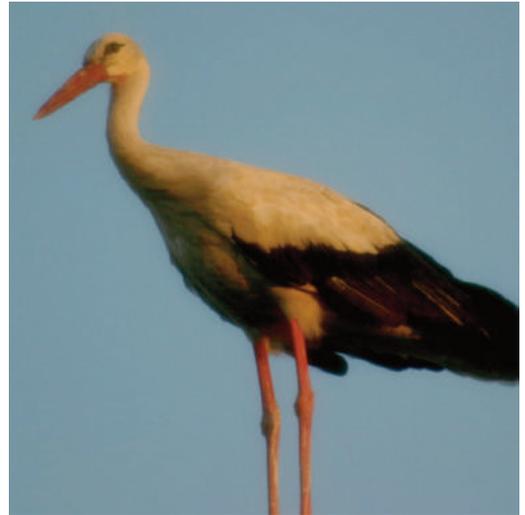
1. **Mainstreaming schools education** (April – June 2018)
Theory and application for the visiting schools. Day visits and regular scheduled visits are planned for school groups aged 7 – 17, including those with special educational needs.
In progress.
2. **Research and education** (February 2018 – May 2020)
Assessing the performance of students in collaborating environmental sciences and biology institutions.
3. **National Children's Day Picnic** (April 2018)
A gathering to raise awareness of the 'Big Issues'.
4. **Applied education** (ongoing)
Training for farmers and permaculture practitioners and volunteers; encouraging younger generations to be farmers that want to move out to the countryside and produce.
5. **Teacher training** (March – September 2018)
Training in understating nature and incorporating environmental science into classroom activities.
6. **Rewilding coaching** (May 2018)
Aimed at corporate managers and academics.
7. **Special nature events** (July – September 2018)
Observing phenomena such as migrating white storks staying overnight and fireflies' mating dance.

EVALUATION

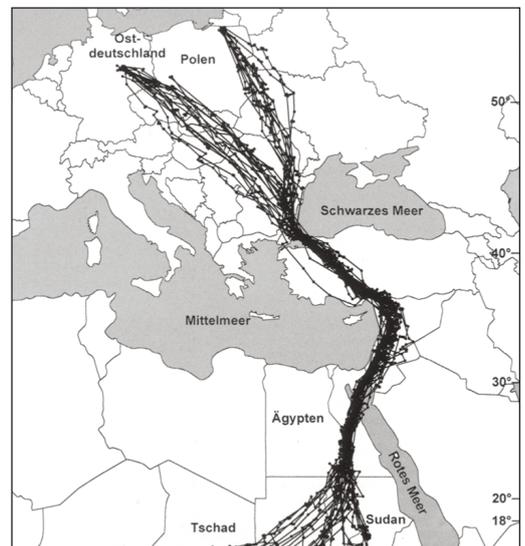
So far we have been tracking feedback using a visitors book and are preparing to use Kirk Patrick's education evaluation methodology to:

- assess visitor response via a training evaluation form.
- assess learning before and after training to look for behavioral change

Our driving force and aim is to create a mutual language of interaction, with strong academic grounding to eventually become an institutional hub for education in natural sciences in an outdoor setting.



↑ One of the many white stork (*Ciconia cicconia*) that visit each year to spend the night at Malva Permaculture Farm ©Melike Muezzinoglu



↑ Autumn migration route of the White Stork, channelling through the garden and its proximity ©Malva Permaculture Farm

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DEVELOPING ALLIANCES BETWEEN BOTANIC GARDENS AND UNIVERSITIES

Botanic Gardens and museums share many aims and modes of operation. However, their differing approaches to these can be complementary. This paper outlines some of the ways these organisations are working together to develop and implement effective education programmes.

Botanic gardens and universities are institutions with many shared roles and objectives. For example, both contribute to quality of life and the resolution of environmental problems through knowledge generation and application of research through conservation. For this reason Bertachini et al set out to prove that collaboration between universities and botanic gardens, which is becoming increasingly common, can be advantageous (Bertachini, Vieira, Rosario, 2017).

From a public engagement perspective, time and time again, we see that effective partnerships between universities and botanic gardens can produce fruitful education projects by feeding on the shared and unique expertise of each type of institution. This paper argues that by developing long-lasting relationships with universities, botanic gardens can improve

↑ Participants of the first LearnToEngage module developing interpretation at the Arco Arboretum in Italy ©LearnToEngage

***Bertachini et al set out to prove that collaboration between universities and botanic gardens, which is becoming increasingly common, can be advantageous.
Bertachini, Vieira, Rosario, 2017***

their education offer, developing projects and programmes with enhanced academic rigour and pedagogy. And, vice-versa, a university can benefit by drawing on botanic gardens' skills in outreach, informal education and community engagement. This is illustrated through four case studies.

CASE STUDY 1

The University of Montreal, Canada in partnership with the City of Montreal, created the Institute of Plant Biology Research and the Center for Biodiversity, located in the Montreal Botanical Garden. The Center was created with the objective of promoting research in and teaching of plant biology as well as raising public awareness. In addition the center's mission is to maintain and preserve important biological collections, such as the Marie-Victorin Herbarium, Oudete-Robert Entomological Collection, an Entomological collection of Insects of Montreal and the Circle of Micologists of Montreal's collection (Espace pour la view Montreal, 2017).

The institute offers training for undergraduate and postgraduate students who are interested in the field as well as public engagement activities. Research is focused on basic and applied research and involves university professors from disciplines related to plant biology and professionals in molecular biology and ecology (Centre sur la Biodiversité, 2017). The Center contains state-of-the-art laboratories which carry out large-scale studies, enabling the discovery of new species, among them species of economic and industrial interest (Espace pour la view Montreal, 2017).

CASE STUDY 2

LearnToEngage training modules have been developed through a partnership between BGCI, Muse science centre in Trento, Italy, Royal Botanic Garden Edinburgh, UK, the National Museum of Natural History and Sciences of the University of Lisbon, Portugal and Nottingham Trent University, UK and is funded by the European Commission's Erasmus+ programme. The blended learning (online and face-to-face) professional development modules for botanic garden and museum professionals focus on Interpretation, Working with Diverse Audiences, Science Communication and Research and Evaluation. LearnToEngage seeks to enhance public engagement with audiences and encourage robust research and evaluation activities at botanic gardens and museums. To achieve this the LearnToEngage partnership draws on the expertise of its members in providing high-quality education while Nottingham Trent University offers its expertise in evaluation and education research to support high quality content as well as rigorous quality management and evaluation processes to improve the offer for future cohorts. (LearnToEngage, 2017).

CASE STUDY 3

Since 2011, the Botanic Garden of the University of Ljubljana, Slovenia has recruited senior citizens enrolled in courses related to the work of the garden, such as botany and landscape architecture, at the University of Slovenia, to volunteer at the garden. The botanic garden provides training to the students in areas that both interest them and support their academic study. They can also take part in small-scale conservation projects such as helping to eradicate invasive species. In return the students bring visitors into the garden through word of mouth and support the visitor services by volunteering their time. The programme has led to the garden attracting a lot of media attention which has consequently attracted new visitors. This has also led to the reopening of the garden's tropical greenhouse, which had closed due to staffing issues. The programme has also popularised the concept of volunteering; still rare in places like Slovenia and neighbouring countries (Derewnicka *et al.*, 2015).

By developing long-lasting relationships with universities, botanic gardens can improve their education offer by developing projects and programmes with enhanced academic rigour and pedagogy. And, vice-versa, a university can benefit by drawing on botanic gardens' skills in outreach, informal education and community engagement.



↑ An intergenerational workshop on botany at the University of Ljubljana ©Tamara Jare

LearnTo
Engage 
Portugal • United Kingdom • Italy

By seeking to develop education programmes in partnership, botanic gardens and universities can draw on each other's expertise and infrastructure to enhance their work.

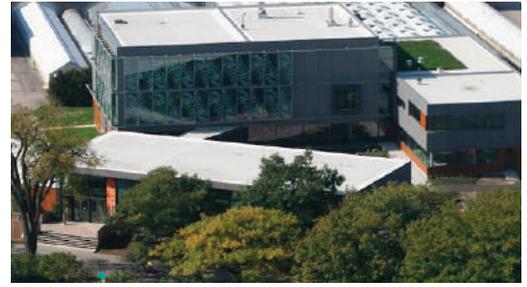
CAST STUDY 4

Since its inception in 1991, the University of Bristol Botanic Garden, UK has effectively fulfilled the much needed role of a university botanic garden. It has developed education programmes not only for the general public but also for a university community. The garden staff are mainly professors and researchers of the university that have generated knowledge regarding native and exotic plants and their functions in the ecosystems. The garden has improved plant-based education by enhancing the undergraduate and postgraduate curricula in the Faculty of Biological Sciences. It provides a space for learning and applying knowledge as well as a source of plant material. It has also improved the environmental education offered. In addition the garden reaches the wider public to share messages about the importance of plants and conservation (The University of Bristol, 2017)).

CONCLUSION

In all four cases, the collaboration between botanic gardens and universities contributes to research, teaching, dissemination and environmental education. The target audiences and aim of the partnership differ yet in each case there can be seen a clear benefit arising from the collaboration. That benefit may be in the form of supporting applied research, enhancing student education, providing rigorous training, promoting a research agenda within botanic gardens, providing a volunteer base to improve visitor services, improving their biological collections or enriching public engagement in general. The way in which these relationships work is also variable. For example, in both Ljubljana and Bristol the university and the botanic garden are in the same locality. For the institutions described in the Montreal and Bristol case studies there are professionals that work at both institutions, such as professors and researchers where as in the other examples above this is not the case.

Therefore, as can be seen from these case studies, collaboration between universities and botanic gardens can be advantageous for both organisations as well as botanical and environmental education provision in general. By seeking to develop education programmes in partnership, botanic gardens and universities can draw on each other's expertise and infrastructure to enhance their work.



↑ *The Institute of Plant Biology Research and the Center for Biodiversity at the Montreal Botanical Garden* ©IRBV

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← *A workshop on gardening techniques for students at the University of Ljubljana* ©Tamara Jare

SETTING UP A FOREST SCHOOL



Although Lancashire Wildlife Trust has been delivering outdoor environmental education programmes for nearing fifty years now, the Forest School ethos was relatively new to us. Over the last eight years we've been delivering Forest Schools to a range of ages in a variety of contexts, some with no prior experience with nature, and others, who have had a lot of positive engagement with nature. Assistant communications officer Emma Ackerley explains how the Trust successfully set up their Forest School Project, with the support of players of People's Postcode Lottery.

What follows is a concise overview of Forest School development at the Lancashire Wildlife Trust, with tips from experienced practitioners who have been involved in environmental education for nearly fifteen years. They'll try to give you a clearer picture of what it means and what it takes to deliver an effective programme of Forest School.

So, to begin, Forest School is a child-centred, play-based ethos used to encourage children to engage with the natural world. It arrived in the UK around 1993, after a group of nursery nurses from Bridgwater College in the south west took a trip to Denmark and experienced open-air culture at first hand.

They saw children developing individual interests and skills, while enjoying such activities as cooking on open fires, singing together, climbing high up into the trees, whittling and creating their own tools.

↑ *Pupils from St Margaret Mary's Juniors in Liverpool love using these animal puppets to learn about local conservation issues such as protecting red squirrels*
©Emma Ackerley

The project is supported by players of People's Postcode Lottery, which has raised around £350K for the Forest School Project so far.



← Suzanne Stewart, Forest School Project Officer quizzes pupils at St Margaret Mary's Primary in Manchester about hedgehog facts ©Emma Ackerley

Forest School significantly reduces stress and anger levels in children with behavioural problems.
Roe & Aspinall, 2011

This approach to learning and development is thought to have started during the 1950's in many Scandinavian countries, though it was not referred to as Forest School – names include Skøgsbornehaven, Naturbornehaven, Friluftsliv and Skogsmulle (Knight, 2013). These all refer to similar outdoor educational concepts. Since then, similar methods have spread rapidly throughout the UK.

PUSHING THE BAR

Since 2015, LWT's Vicki McDermott, Senior Project Officer and Tim Burrows, Education Manager, have been supported by players of People's Postcode Lottery over the last three years. The £350K raised has allowed a stand-alone intensive Forest School Project to be developed, of which every year we try to push the bar higher both in effective delivery and communications.

Tim Burrows comments, "An effective education programme is often synonymous with a sustainable one. You've got to be very clear from the start about your aim and outputs, i.e. do you want to reach as many children as possible, or do you want to reach fewer children but with a deeper understanding? So here we have either educational school visits for a day, or Forest School where they are provided with sustained visits. So you've got to know what your outcomes are and how you're going to measure your success. To begin with you've got to be creative, because people tell you, you can't do this or that. Just ignore that. You've got to actually go and see what is do-able, and have a go. A couple of things I've tried haven't worked out, but when they do I've always backed them. When things start working, like Forest Schools, we just put a lot more time and resources into it."

Our Forest School Project focuses on delivering to particularly deprived areas, with children who may have a lack of access to the natural world.

The project has three stages, of which the first stage involves the installation of an outdoor area. This includes a seating circle, a parachute (which is used to create a shelter), and central fire-pit for cooking. It's often built in a secluded woodland area within the school grounds or in a local green space. We also provide other equipment such as mud boxes, discovery kits and fire-lighting kits.

Stage two involves a programme of delivery by one of our Forest School Project Officers, and can last for up to a year. We run a two-hour session with groups every week, over a six-week cycle, teaching children new skills which become progressively more challenging towards the final session, which is often fire lighting/using bush knives.



↑ Vicki McDermott, Senior Forest School Project Officer, teaches environmental education to young Luca, 2 at Brockholes ©Alan Wright



↑ Children from schools in Liverpool christen our PPL banner with their muddy hands at our Liverpool Forest School Launch Event at Everton Park Nature Garden ©Emma Ackerley

An effective education programme is often synonymous with a sustainable one.

The third stage can be termed instilling legacy in the project and involves training up three members of staff from schools as level three practitioners. This is to ensure that once we have moved on, there is still a qualified practitioner available to continue delivery.

ADULT TRAINING

Vicki McDermott, Senior Project Officer explains, “After my initial training in 2010 my Forest School delivery was a very small part of my role. When I moved to Brockholes Nature Reserve on a new project, I expressed an interest in delivering more. We looked at getting local schools involved and funding to support delivery at the reserve, I then started delivering Forest School on a weekly basis, year-long programmes with some groups, it was great. A couple of years down the line, I started to look into adult training and contacted Open Awards and the Forest School Association to see what would be necessary.

It has really benefited us having a trainer within the team as we’ve been able to train our staff. However, it’s not essential to setting up a project, and if you decide to take that route it’s time consuming and a lot of work ensuring you have the correct qualifications, and standardizations in place. All in all, it was about a year’s process, we had an enormous amount of support from Open Awards; they would come visit us after every cohort we marked, for external verification. However, now we’ve been approved for internal verifier status which is a huge accomplishment as it tells us we’re doing it right!

Setting up a training programme is a big commitment, but if you just want to deliver sessions the main hurdle is the cost. You need a qualified practitioner, to source essential kit and take time to plan. That’s why we offer the support in applying for funding, and that’s how we’ve encouraged many schools to engage. We’ve also held funding forums, which explain about funding options and what Forest School is – I think they really helped to inform and engage people.”

Research has demonstrated that the Forest School approach has a positive influence on children, stimulating imaginative play outside of school, enhancing leadership and confidence skills and instilling a respect for wildlife (Ridgers et al., 2012). Other studies suggest it significantly reduces stress and anger levels in children with behavioural problems (Roe & Aspinall, 2011) and enhances social skills, language and communication, motivation, concentration and physical skills (O’Brien & Murray, 2007); also such educational methods used with children can help bring about beneficial changes in environmental behaviour of the family and household (Damerell, Howe & Milner-Gulland, 2013).



All of our Forest School work is supported by players of People’s Postcode Lottery. To date, players have raised over £237 million for good causes, as 31% of the lottery is put towards charitable funds and good causes. For more information, see our dedicated

webpage <http://www.lancswt.org.uk/forest-schools> or contact Emma Ackerley at eackerley@lancswt.org.uk.



Lancashire,
Manchester &
N Merseyside

The Wildlife Trust for Lancashire, Manchester and North Merseyside is dedicated to the protection and promotion of the wildlife in Lancashire, seven boroughs of Greater Manchester and four of Merseyside, all lying north of the River Mersey. It manages around 40 nature reserves and 20 Local Nature Reserves covering acres of woodland, wetland, upland and meadow. The Trust has 27,000 members, and over 1,200 volunteers.



↑ Mud kitchens are always a hit at forest schools, and stimulate imaginative play ©Emma Ackerley

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PURWODADI BOTANIC GARDEN'S GOOD EDUCATION PROGRAMMES: ENGAGING STUDENTS, TEENAGERS AND COMMUNITY

Purwodadi Botanic Garden has a 'grand design' in its Good Education Programmes (GE Pro), currently under development to promote environmental education and awareness of the diversity of Indonesian flora. This innovative scheme includes establishing environmental education modules for schools, thematic garden tour modules for general visitors, an online reservation system for greater efficiency, an information game called Kendil's Adventure to engage young people, and a dynamic display exhibition of Purwodadi's information centre. Continuing development and upgrading will be maintained to ensure quality of service, customer satisfaction and public outreach.

PURWODADI BOTANIC GARDEN AT A GLANCE

Purwodadi Botanic Garden is an 85-hectare garden located in Pasuruan, East Java, Indonesia. It was established in 1941 and is now state governed and reports to the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia/LIPI), operating in the field of conservation and research of Indonesia's dry lowland plants, as well as environmental information and public education services. To date, some 11,000 plant specimens have been conserved here, collected over a wide area, particularly in eastern Indonesia. The garden has a number of attractive, thematic areas, such as the Aquatic Plants and Ferns Park, Bougainvillea Park, Mexican Park, Palm Avenue, Bungur Avenue, Randu Avenue and so on, all helping to create one of the most popular tourist destinations in East Java.

↑ Purwodadi Botanic Garden iconic view: Randu Avenue ©Purwodadi Botanic Garden

"It was fun to learn in the garden instead of the classroom! I learned that plants are very diverse and important to our life."

Nadya, Kalirejo Lawang Elementary School student



GOOD EDUCATION PROGRAMMES

Public engagement with the environment by providing information and education is one of our key performance measures, as outlined in target 14 of *The Global Strategy for Plant Conservation* (GSPC) and *The Indonesian Biodiversity Strategy and Action Plan* (IBSAP) 2015–2020 (Darajati *et al.*, 2016). In 2016, Purwodadi Botanic Garden engaged with some 15,000 users of environmental education programmes – the highest number of any of the four botanic gardens in Indonesia. To improve and promote the quality of its public services further, Purwodadi is developing new schemes under the title *Good Education Programmes* (GE Pro). The action plan for GE Pro began in 2017 and should be fully implemented by 2020. In the first six months, GE Pro succeeded in establishing four new service products and a concept for an information centre.

To reach a wide range of stakeholders, an intensive programme of off and online promotion strategies were developed.

Offline:

- On 14th June, the first four outputs of GE Pro were soft-launched and then trialled with some schools representing the different levels: elementary, junior and senior high schools.
- We took GE Pro to the local government of the Pasuruan District through the Office of Education and Office of Tourism and Culture to gain official support.
- Attractive and informative banners and interpretation boards, together with flyers for GE Pro were set up at the main gate and distributed around the garden.
- Plans are in place for a roadshow to some stakeholders, mainly schools.

Online:

- Regular online promotion via social media such as Facebook, Instagram and Twitter are effective in reaching youth and general visitors.
- Promotion via other websites e.g. our official website, LIPI website, and national media.

Enthusiastic and positive responses from students, teachers, evaluators, and general visitors have been received, indicating that we are helping to build communities of learners who appreciate the beauty and value of nature. Up to the end of August this year, Purwodadi Botanic Garden has engaged with 10,254 users from a wide variety of schools and communities for environmental education programmes (both existing and through GE Pro), and numbers are growing.

The environmental education components of GE Pro are a mix of botanical information and activities designed to complement existing school curricula in plant science and provide resources for schools. With the programmes, students can study the modules whilst being able to see the real plants in the garden. The thematic garden tour component is a series of tours which consider elements of our plant collection and interpret them based on certain topics. The pilot focusses on local fruits but this will be expanded to include medicinal plants, aromatic plants, orchids, bananas, etc. The target is broad audiences of learners including undergraduate students and general visitors.

← cover images for environmental education options and thematic garden tour ©Purwodadi Botanic Garden



KENDIL'S ADVENTURE

↑ Mascot of Kendil's Adventure
©Purwodadi Botanic Garden

'We hope through our new innovative Good Education Programmes, Purwodadi will make advances in public awareness about the richness of Indonesian flora in ways that are more informative, user-friendly and fun.'
Titut Yulistyarini, Project Leader of GE Pro



↑ A student excited at playing Kendil's Adventure: at the fishtail palm, *Caryota mitis*
©Purwodadi Botanic Garden

'I am amazed how my smartphone can help me in learning about plants in the garden! EXPLORATIVE, FUN and SMART is the motto.'
Bayu, Purwosari Vocational Senior High School student

The programmes run on weekdays by reservation and an online reservation system was designed as part of our integrated online services (<http://krpurwodadi.lipi.go.id/reservasi/ver2/>). All available options can now be found on the system so that customers can choose and reserve the most suitable packages for them. This efficient system will hopefully engage a larger and wider audience.

In the two months after the programme was soft-launched, over 60 users played Kendil's Adventure. The game is a self-guided adventure designed to provide a more interesting and challenging garden tour, especially for technology-conscious young people. It successfully combines digital learning with outdoor experience.

Kendil's Adventure is web-based and can be accessed through smartphones at <http://krpurwodadi.lipi.go.id/adventure/>. Players are challenged to locate individuals in the plant collection using maps available on screen. By entering the unique code found next to the target, they can access information such as plant descriptions, ecology, potential uses, etc. There are also videos. When an individual has completed level one, they get a virtual certificate of completion that can be exchanged for postcards, stickers, pins, bookmarks, etc. Feedback from users varied, some thinking the system was very challenging and fun to play, others that it was too easy. All definitely would recommend it to friends for learning about plants in the garden, and would play the game again, especially when the levels are expanded.

Last but not least, the Purwodadi Botanic Garden information centre's dynamic display exhibition (Gedung Informasi Perkebunrayaan) is a long-term programme which is still in the developmental phase; it will be ready in 2018. It is intended as an information hub, display of the diversity of Indonesian flora (the first in East Java), and a facility to disseminate our research findings to the public – it is also intended support all of our environmental education programmes.

The GE Pro product services are actually system supports. We are using the garden as a classroom, and students learn things such as: What plants and which parts of the plants can you eat?, How can we grow a tree?, How long will it take to fruit?, etc. By making a connection between learning and the real world, students feel an increased drive to understand.

All the GE Pro services are designed to foster interest in the environment by giving opportunities for students, teenagers and the wider community to appreciate the high diversity and value of Indonesian flora, to develop critical thinking skills, an awareness of threats, a care for the environment and an understanding of the necessity of conservation efforts (especially in Indonesia).

CHALLENGES AND NEXT STEPS

We face some challenges both in development and in ensuring a sustainable roll-out of GE Pro, both internally and externally. These included:

1. Facilitator competence – in order to standardise the perception, understanding and competencies among facilitators about the new services extensive internal training must be provided.
2. User buy-in – some schools following our existing programmes for environmental education develop their own activities, but in this new GE Pro they should use our new services. Introduction of GE Pro modules to schools will be presented and promoted in ways to gain more support and buy-in.
3. Continuous development for medium and long term implementation – to maintain and improve the quality of services, all GE Pro products must be developed on an ongoing basis, with upgrading, diversification, etc. As mentioned, all services are to be expanded.

'Environmental education is integral to Purwodadi Botanic Garden's accountability to the public. Therefore, we are continuously innovating our programmes to improve quality and effectiveness, to meet customer needs and satisfaction, and particularly to support good environmental education in Indonesia.'

R. Hendrian, Director of Purwodadi Botanic Garden



↑ Elementary school students taking notes during an explanation by Febrina Siahaan (facilitator)
©Purwodadi Botanic Garden

'Fieldwork broadens horizons! Thank you for giving our students environmental education opportunities, inspiring them to love plants and nature, to expand their knowledge and engage in environmental issues.'

Wanta, Pandaan Senior High School teacher

We are currently preparing further thematic education offers including plant propagation (conventional and tissue culture), making fertiliser and producing herbarium specimens. Audiences have also suggested we should also design an environmental education programme for pre-school level, that being a critical time to build their children's interest, passion and awareness of nature.

4. Limited budget – particularly in the development of the dynamic display exhibition the cost is projected to be very high. Our funds are strictly limited and this is exacerbated by cutbacks to public budgets, forcing us to seek other ways of securing funding and to diversify sources. We have prepared a project proposal that will soon be submitted to private funding bodies. We are also open to partnership and cooperation with stakeholders to develop the programmes.

CONCLUSION

Purwodadi Botanic Garden has always had a strong commitment to education, promoting knowledge and care for nature. The garden is truly a haven for plants and for people. Ultimately, we think GE Pro is helping to engage younger generations, through a wide range of opportunities, encouraging them to form emotional bonds with plants and nature, for civic-minded engagement in environmental issues. We see it as a tool to promote the understanding and conservation of Indonesian flora to the wider general public, engaging future generations so that Indonesia can continue to be a globally important biodiversity hotspot.

We are convinced that outdoor education can prepare young people for the future! "Must we always teach our children with books?" naturalist David Polis once asked, and declared: "Let them look at the mountains and the stars up above. Let them look at the beauty of the waters and the trees and flowers on earth. They will then begin to think, and to think is the beginning of a real education."

To learn more about Purwodadi Botanic Garden and our Good Education Programmes, visit our official website: www.krpurwodadi.lipi.go.id

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↪ *Undergraduates from Brawijaya University carrying out fieldwork on local fruits at Purwodadi*
©Purwodadi Botanic Garden



PIONEERS IN PUBLIC ENGAGEMENT

ANN VOZZOLO

On any given Wednesday afternoon, visitors to the Marie Selby Botanical Gardens Kids' Corner, in Sarasota, Florida, will find volunteer Ann Vozzolo quietly and happily tidying the space, or preparing materials for an upcoming activity, all the while engaging visiting families. When it comes to serving families, the garden has done much to improve offerings and create a comfortable environment since opening the Ann Goldstein Children's Rainforest Garden in 2013. What's important to families is the quality of the space and interactives, and the enhanced engagement that a good volunteer can provide. Ann's pleasant and peaceful demeanour has built a loyal group of repeat visitors who like to go and see her in the Kids' Corner.

Ann has been a volunteer at Selby Gardens since September 2013, and has since accumulated more than 800 volunteer hours, 150 of them just in 2017. Besides her regular shift in the Kids' Corner, Ann can be counted on to volunteer for Little Sprouts Club, our monthly preschool program. She prepares crafts in the days leading up to it, helps set up tables, sensory stations and games, gently guides children in creating take-



home craft projects and is the last volunteer to leave after clean-up. Ann has also taken the helm of Little Sprouts Club, capably leading the program during times of staff transition and absences.



↑ Ann Vozzolo explaining epiphytes to Oak Park students

Among the many extraordinary things about Ann, what really stands out is her commitment to extend our science curriculum to high school and college level students with significant cognitive impairments from Oak Park School (<http://sarasotacountyschools.net/schools/oakpark/>), a local school which serves 300 children with disabilities. For the last three years, Ann has worked with one class whose teacher wanted her students to experience all of our scientific inquiry-based schools' offer on a regular basis to help foster an appreciation for the natural world.

Ann, a retired teacher, is the perfect match for this program. She was excited to work with them and to share the gardens with these inquisitive young people, which led to the building of a relationship with both the students and the teachers through their numerous visits during the school year. The teacher had been documenting their visits and, at the end of the first year, shared a video card of thanks to Ann for her time and creativity. We shared the card with some donors who have since underwritten admission for this group of students. We're happy to say that three years later they continue to return regularly to explore the beauty and wonder of the natural world, led by the selfless and exemplary person that is Ann Vozzolo.

Ann supports the following programs:
<http://selby.org/programs/school-programs/> and
<http://selby.org/programs/little-sprouts-club/>

RESOURCES



Running a Museum: A Practical Handbook

The International Council of Museums (ICOM) published this handbook to provide an overview of the key aspects involved in running a museum. Aimed at both museum starters and seasoned professionals, it includes 12 chapters with valuable information and advice from experienced authors about museum development. Particularly, chapter 7 (Museum Education in the Context of Museum Functions) could be useful for those interested in designing educational programmes.

http://icom.museum/uploads/tx_hpoindexbdd/practical_handbook.pdf

Thinking About Starting a Museum? A discussion guide and workbook on museums and heritage projects

This booklet, written by Crystal L. B. Willie for Museums Alberta, offers a brief overview of museums as spaces to support community heritage. It can be used as a guide or as a workbook to help understand processes related to working in heritage. The open questions in the booklet help the reader to identify goals, objectives, and needs which could be very useful to anyone wanting to set up a new education programme.

<http://www.museums.ab.ca/media/16939/thinkingaboutstartingmuseum.pdf>

Developing and Supporting Family Learning in Museums and Galleries

Families are an essential audience for most botanic gardens and therefore offering them a rewarding education



programme is a must. This resource was created by The NIACE (The National Organization for Adult Learning) and Renaissance North West (a partnership of museums in the North West of England) to share the key principles and practices for working with families in a learning environment. The document not only outlines how to develop a family learning offer, it also covers important practical aspects, such as funding and policy.

<http://shop.niace.org.uk/media/catalog/product/F/a/Family-Learning-Museums-Galleries.pdf>

4 Ways Museums Can Engage Millennials

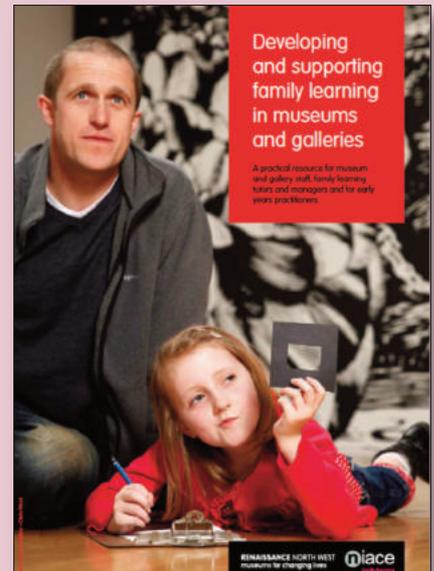


Young people are a common missing audience group for botanic gardens. This blog from Melissa Wall contains four broad considerations that can help when it comes to inspiring and engaging with the millennial generation. Some of her recommendations could be adopted to develop new educational offerings to attract this audience.

<http://www.achieveagency.com/4-ways-museums-can-engage-millennials/>

Technical Leaflet: Designing Education Programmes that connect students to collections

The American Association for State and Local History (AASLH) has created a leaflet that provides some strategies that can bring collections closer to students.



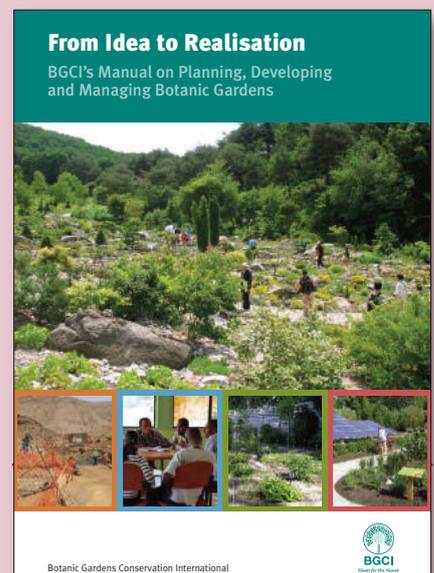
It includes some methods to evaluate national curricula to identify and consider the needs of both students and teachers. It also serves as a guide to developing learning programmes within the context of museum and botanic garden collections.

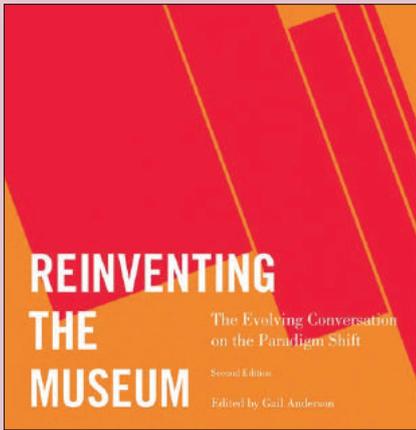
<http://resource.aaslh.org/view/designing-education-programs-that-connect-students-to-collections/>

From Idea to Realisation – BGCI's Manual on Planning, Developing and Managing Botanic Gardens

BGCI created this manual to support the development of botanic gardens and arboreta. Chapter 7 focusses on public engagement and education, offering information and recommendations for developing educational programmes, as well as case studies from around the world.

https://www.bgci.org/files/BG_Manual2017/BGCI%20Manual.pdf





Gail Anderson, AltaMira Press

Reinventing the Museum: The Evolving Conversation on the Paradigm Shift

This book, written by Gail Anderson, consists of a series of articles on the evolution of the role of museums. It covers the ways in which museums have adapted their public engagement in the 21st century, and provides information and suggestions for further reading that can help the reader to understand the core ideas and essentials of the museum field today.

<https://rowman.com/ISBN/9780759119659/Reinventing-the-Museum-The-Evolving-Conversation-on-the-Paradigm-Shift-2nd-Edition#>

My Primary School is at the Museum: Inspiring schools and museums across the UK to build museum- school partnerships

As part of a bold project from King's College London, three primary schools in the UK moved into museums for several weeks for all their lessons. The report stresses the importance and benefits that

Amgueddfa Cymru



a museum-school partnership has on children's learning. It also provides some of the challenges and recommendations resulting from these partnerships.

<https://www.kcl.ac.uk/Cultural/Cultural-Institute/161107-Primary-at-Museum-Report-Stage-7-Visual-interactive.pdf>

Education and Interpretation Recorded Webinars

The American Alliance of Museums provides a set of webinars with useful information that can be applied in the context of botanic gardens and museums. Among them, Planning for Technology, Road to Results: Identifying, Researching and Building Audiences, and Excellence and Equity: Then, Now, Next, can help with many aspects involved in developing new public engagement offers covering, for example, how to adapt to new technologies, reaching new audiences, and the role of museums in society.

<http://www.aam-us.org/resources/online-programs/education-and-interpretation-webinars>

The 5 Ds: A Collaborative Model for Learning Design (Part 1)

This article from Bonnie Budd shares the framework that the Teaching and Learning Lab (TLL) at the Harvard Graduate School of Education (HGSE) developed for institutional designers and those who are interested in designing projects and programmes. The 5 Ds are Discovery, Design, Development, Delivery, and Debrief. This article focuses on the first two, and recommends collaborative working between institutional designers and other stakeholders (students, programme directors, and professionals from other fields) in these particular stages. It also presents some questions that could help botanic gardens guide discussions in order to design effective programmes.

https://evollution.com/programming/program_planning/the-5-ds-a-collaborative-model-for-learning-design-part-1/



Our Museum: Communities and Museums as Active Partners

Adopting participatory approaches within botanic gardens and museums can lead to more effective relationships with local communities. This programme from The Paul Hamlyn Foundation was created under exactly that belief. Their website provides a variety of tools, ideas, and case studies that can provide inspiration for those looking to develop collaborative programmes.

<http://ourmuseum.org.uk/?welcome=1>

The Chronicle of Philanthropy

Fundraising is a necessary evil when it comes to developing new programmes and activities at botanic gardens. This independent news organization can help non-for-profit organisations to access funding. As well as webinars that can help you to develop your fundraising skills, the website offers a database of grants.

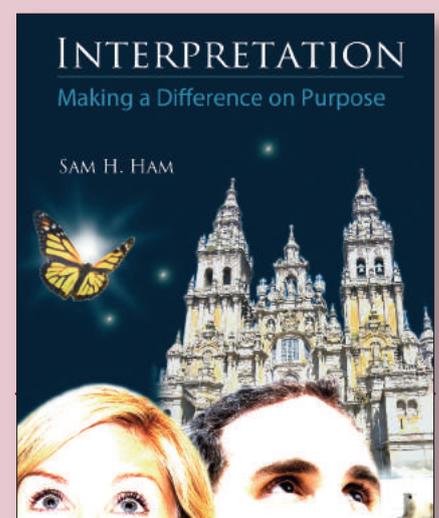
https://www.philanthropy.com/page/about-the-chronicle-of/531?cid=cpf_abt

Interpretation: Making a Difference on Purpose

Interpretation is an essential element of public engagement at botanic gardens. Yet it is not easy to create effective and engaging offers. Whether you are starting from the beginning, adding to what's there or revamping your old interpretation, this book is essential reading. As one of the most well regarded books on interpretation, it covers everything you need to know when developing interpretation and writing.

<https://fulcrum.bookstore.ipgbook.com>

Sam H. Ham, Fulcrum Publishing



Contribute to the next issue of Roots

A great way of developing exciting education projects that have long lasting learning outcomes is by considering how people learn and by grounding your work in effective pedagogy.

Are you a researcher working on learning theories in informal education?

Are you a botanic garden educator who has successfully applied a new pedagogy?

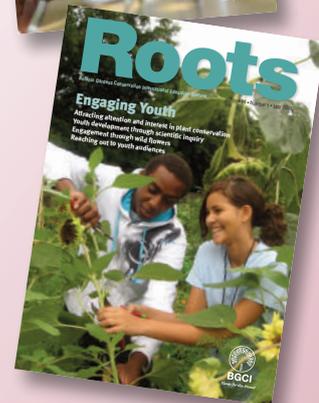
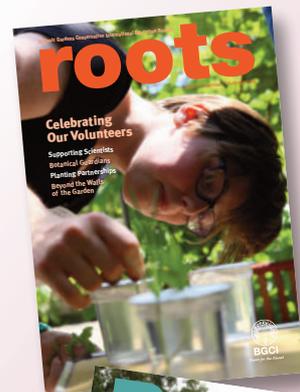
Does your garden base its public engagement projects on academic theory?

We want to hear from you!

The next issue of Roots will be about applying learning theories in botanic gardens and museums.

We are currently seeking a range of contributions including articles, profiles of amazing educators and reviews of great resources. To contribute, please send a 100 word abstract to Liliana.derewnicka@bgci.org by **5th January, 2018**

Find more information online: bgci.org/public-engagement/roots/





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Call for abstracts: November 2017 – March 2018



Steven Handel

Hosted by the University of Warsaw Botanic Garden, the next Education Congress will take place from 10th – 14th September, 2018.

The theme of the congress is Bringing nature to the city: Celebrating the 200th anniversary of the University of Warsaw Botanic Garden. We will be welcoming abstracts for a range of formats of presentations on a variety of sub themes from 30th November, 2017.

Find more information on the congress website:
garden.uw.edu.pl/congress2018.



BGCI

Plants for the Planet



9-14.09.2018

BGCI's 10th International
Congress on Education
in Botanic Gardens
WARSAW | POLAND