ECOCLUBS AS A TOOL FOR ENVIRONMENTALLY EFFECTIVE COMMUNITY DEVELOPMENT

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Abstract

Ecoclubs were formed in 12 disadvantaged schools. Teachers, students and parents were sensitised to the benefits of organic farming, recycling and composting through a variety of activities. Students were further motivated through competitions and quizzes, and the opportunity to explain their work to other adults and students at exhibitions and fairs. A few students were selected for LEWS (Learning Earning While Studying) where home farming provides income to go towards higher education costs. Participating schools are now recycling waste and growing organic vegetables and mushrooms to supplement school meals and provide income. The confidence and self-esteem of Ecoclub students has markedly improved, and interest in environmental issues has percolated through into local communities and government. “Children as students” have become “students as resources”.

Introduction and context

The context is Education for Sustainable Development (ESD), a new vision of education, empowering people of all ages to assume responsibility for creating a sustainable future (UNESCO, 2004). Individuals and social groups are motivated and equipped to make informed decisions and create a more sustainable world. IUCN-2004 recognises that education programmes must reflect the importance of living in a sustainable way, and there must be a significant change in attitudes and practices. Similarly, the Convention on Biological Diversity Article 13 *Public education and awareness* highlights the importance of approaching these issues via education.

The increasing and indiscriminate use of chemical fertilisers and pesticides in the Nilgiri Hills of south India is causing land degradation and a decline in soil fertility. Young people are leaving the land for the cities; schools are in decline with reducing rolls, limited resources, and lack of motivation. In addition, poverty and lack of skills in English are holding children back.

Introducing Ecoclubs to the Nilgiris was timely, in that a GREENS biodiversity sanctuary was being proposed. The EARTH Trust, an NGO working with communities in the areas of sustainable health, farming and the environment, provided useful contacts and an umbrella for the new work.

50 enthusiastic, environmentally-concerned and socially-committed students aged 7 to 13 were chosen to form each Ecoclub, supported by 2 teachers. The aim of the Ecoclubs is to develop a green consciousness and social responsibility: through them we promote recycling, composting, organic gardening and efficient use of land (Alexander and Britto, 2002). Ecoclubs are internationally recognised as a powerful tool to change the community through the activities of children.

This paper will describe how students and teachers were motivated; how schools with limited resources have been empowered; and how Ecoclubs have made a tangible difference at grass-roots level.

The beginning

As funds were lacking for all but the very basic costs of transport and maintenance, the project began in a modest way with visits to more than 20 schools in parts of the Nilgiris already identified as being disadvantaged. Long discussions with head teachers and teachers, over a number of visits, were necessary to get buy-in from, in the end, 12 schools. The concepts were unfamiliar and there was much initial suspicion as to our motives. We had to explain the purpose of the project, the principles of organic farming and the expected outcomes in a simple and straightforward way to gain confidence and build the relationship. Ensuring that all the teachers not only participated but were able to voice their doubts and fears was vital.

At the same time, we were building relations with the Ecoclub students by treating them as equal stakeholders and encouraging them to provide solutions to the problems they identified. Messages were reinforced and information given as informally as possible, through games, video shows - one on the Slow Poisoning of India (by pesticides) had a strong impact on students and teachers alike; a 3-day environment leadership course for teachers; hill trekking and a wilderness outing. This was the first time many of the participants had looked at their surroundings from the environmentalist's perspective.

Development of activities

The Shola Forest is one of the Nilgiris most spectacular natural features, consisting of patches of high-altitude (around 2000 metres) stunted evergreen forest separated by undulating grasslands. It is noted for its endangered ecosystem and endemic species. Consequently a Shola Forest Experience Programme (SFEP) was exclusively designed for Ecoclubs members, whereby indigenous forest was contrasted with manmade forest (usually eucalyptus plantation) regarding diversity of species, soil building, and the natural processes through which a forest matures. The key to the success of the SFEP is the way it links the local forest eco-system to a school organic garden - both students and teachers began to understand the principles of organic farming from observing nature.

Following on from awareness raising and exposure events, we began to bring the students and teachers face to face with others working in the field. A number of successful small-scale organic farmers invited the students to their farms; various experts from the FAO and from Natura Organics in Faridabad gave advice to students; and Dr Linda Weiner, an entomologist, trained students and teachers on the identification of pests and the role of natural predators.

Compost making was fundamental to the project and the students found it extremely enjoyable, so much so that a compost competition and a biodynamic quiz attracted many participants. Veverka (1998) says *"learning requires activity on the part of learner and friendly competition stimulates learning. Besides, knowing the usefulness of the knowledge being acquired makes learning more effective. People learn best from hands-on experience"* and compost making is a prime example of that!

Soil health building went on for a period of six months after which students moved on to organic gardening, experimented with mixed cropping and noted the advantages include decreasing pest problems, better usage of land and sunlight. "*Malnutrition begins with the soil. Many nutritionists & physicians now agree that there is really only one disease - malnutrition - that all other diseases derive from. The growth and health of our bodies depend upon the growth and health of plants*." (Tompkins & Bird 1989). Now twice a week the gardens provide vegetables for the noon meal programme.

The school garden programme must be well adapted to local customs and needs and the specific socio-economic, climate and environment situation (FAO 2004). It reduces school drop-outs due to poverty and enhances the self confidence of the participants.

FAO (2004) also states that it is important to "*Improve school children's nutrition by supplementing school feeding programmes with variety of fresh micronutrients and protein rich products, and increase children's knowledge of nutrition, to the benefit of the whole family"*. We therefore began mushroom cultivation at the Panchayat Union Middle School (PUMS) Thenallai, in July 2005, and so far five batches of mushrooms have been cultivated with around 25 bags from each batch. After hands-on training, the process is entirely the responsibility of the students and teachers, and a steering committee monitors the programme. The project merely provides the spawn. Certain students have taken up mushroom cultivation at home, where it is a source of additional income.

The steering committee meets once a month. It is made up of mothers, teachers, head teachers, noon meal organizers, cooks, education staff and selected students. It acts as the bridge between the school and the community. According to Taylor (2004-2005) *"a school garden is a great project that can appeal to an eclectic mix of the community group"*.

The final innovation which must be described is LEWS - *Learning Earning While Studying).* The main aim of the programme is to enable poor rural students, preferably female, to save for their higher education, using their mushroom and organic gardening skills.

Widening the scope

Once organic farming and mushroom cultivation were established, the Ecoclubs were encouraged to share their knowledge with others. They also engaged in public awareness campaigns around the Nilgiris - on litter and use of plastic, for example.

A large exhibition, *SETO 2006* (Science, Environment, Technology and Organic farming) was organised in collaboration with Ahumcaara Organics, Chennai. Two years into the programme, Ecoclub schools were confident enough to share their experience with others. The exhibition created significant impact among government departments and the press gave wide publicity to organic farming. This exhibition also created opportunities to organise linkages between village and town schools and there will be an interchange with the city-based school children of Chennai to help them find their roots and reconnect with nature. *"Bridging the gap"! Community awareness cultivates support from peoples, organizations and local business that would like to become involved, donate funds or volunteer their time"* (Taylor 2004-2005)

Active Ecoclub students who were passionate about gardening and who had good communication skills were selected for a five-day intensive hands-on training course, along with Ecoclub teachers and noon meal organizers. The training covered organic and biodynamic farming and how this can be replicated on their own farm and transferred to the community. This was known as the *Organic Ambassador Programme*, and the young ambassadors acted as spokespersons about the organic garden, mushroom cultivation, and waste recycling to their peers and visitors to the schools.

Thenallai school attracted many visitors including the Director General of Agriculture, Bhutan, who came to the Nilgiris with 20 of his agricultural and horticultural extension officers for a one-day workshop. As a result they presented a sum of R 1600 (£20) to the

school for the future development. Less able students in the class communicated in a very effective way and this changed the perception of the teachers.

Last but not least the education coordinator simultaneously started organic rice farming on his own land with traditional rice successfully harvested and brought to the school for an "organic pongal day". All these kinds of activities boost the confidence of the students and teachers.

Naturally, the programme was not without its problems. Key teaching staff would be transferred mid-project; not every school welcomed the initiative; and there was the perennial problem of funds. Fortunately, as the project developed we were able to attract sponsorship which allowed us to expand our work, pay ourselves, and buy a motorbike for visiting the schools.

The budget, though, is still modest. To date we have spent about R 600,000 (£7500) on the whole programme (that includes the value of sponsorship), and includes pay and travel for two staff for two years of R 425,000 (£5300). A lot can be done with small amounts of money - for example, hill trekking for 100 students and 13 teachers from 10 schools cost R 5400 (£65), and the Shola Experience programme R 2000 (£25) per trip.

Results and plans

It is fantastic to see how the self-confidence of disadvantaged students is enhanced by their new "life skills". The children are models for their peers, acting more responsibly and transferring ecofriendly technology to their villages. The schools too benefitted from the progarmme: many visitors were attracted to the school gardens, including overseas visitors, which did a lot to increase the self-esteem of children and teachers, and they won praise from higher officials, the local community and neighboring schools.

The impact on nutrition has been noticeable through the supply of organic food and mushrooms to the noon-meal programme. And the relationships between the students, teachers, cooks, and mothers have been strengthened. The Thenallai school noon meal organiser has offered her land for growing more organic vegetables to support the school meal progarmme.

For the future we want to strengthen the management of the programmes to make less of a demand on project staff time, as there are other schools who want to set up Ecoclubs. Therefore we shall help teachers to set up steering committees for Ecoclub activities; persuade other noon meal organisers to replicate organic farming around the district and state; and set up a LEWS parents' association to help to consolidate their children's mushroom projects.
We shall also continue to build city-rural links - the Ecoclub organic ambassadors will run a workshop for the city children in Chennai.

Conclusions

Ecoclubs make a difference. Ecoclub schools are showcases that influence other schools and local communities and by sharing their experiences they transfer environmentally friendly technology to the communities through a community based organic movement. *There are solutions to the major problems of our time; some of them even simple. But they require a radical shift in our perceptions, our thinking, and our values." (Fritjof Capra, 1996*)

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Botanical recollections: Creativity with people over 50

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Image 1 Participants sketching in the Botanic Garden. May, 2005

Overview

Botanical Recollections was an art and creativity project run especially for participants over the age of 50. The group met once a fortnight throughout the summer of 2005 working with a visual artist and a reminiscence worker. Participants developed skills and confidence for exploring and drawing in the Botanic Garden. The Project used a mixture of visual art, reminiscence work and writing to make pieces of creative work. The project allowed participants to gain new skills and gain creative confidence as well as providing a valuable social network for the group. The project ran from May to August, 2005 giving participants the best chance to see the Garden change from spring to summer. Evaluation carried out by The Campaign for Drawing showed that projects

which engaged with learners over a period of time made the most demands on staff but had the most impact on the learners involved.

Aims

Botanical Recollections was a project funded from The Campaign for Drawing (a UK charity) to encourage people over 50 to participate in drawing activities in heritage sites. The Garden's aims for the project also included the engagement of local people who had not previously visited the Garden. Our neighbours in 'East Oxford' represent the most culturally diverse residents in Oxford.

Practicalities

The project was set up in partnership with Age Concern, an organisation working with people over 55, championing their rights and helping them to lead fulfilled, interesting lives. Age Concern helped us to recruit individuals by including our flyers in their mail out. They also gave advice on the structure and practicalities of the sessions. They helped us to be aware of issues such as mobility and other physical issues which may affect people over 50. It was extremely useful to benefit from their expert knowledge.

Our funding from The Campaign for Drawing meant that we could provide all participants with sketchbooks, basic drawing materials and season tickets to get into the Garden whenever they wanted. We thought that participants would be interested in trying out new art materials and trying out new, slightly less traditional techniques. We were wrong! They wanted to be taught the 'proper' way to draw with a pencil. They wanted to learn traditional art practices. They especially wanted to be shown how to use watercolour paints, one of the most traditional of art materials! We learnt that the project needed to be flexible in order to respond to the participant's needs and desires.

Developments

It was hoped that by completing the project the participants would gain confidence in drawing but also build confidence in themselves through drawing. We had underestimated the social role that the project gave to the participants. Many looked forward to not only coming to the Garden but also to meeting up with friends that they made on the course. New skills and acquaintances helped to raise self esteem.

We were very keen that the project should run over a number of weeks throughout the summer. It wasn't until nearly half way through the project that participants truly relaxed within the group and become more confident and comfortable with sketching in the Garden. If the project had been shorter, the participants may never have truly relaxed in the Garden.

The reminiscence worker encouraged people to share memories about Gardens and outdoor spaces they had know earlier in their lives. They were encouraged to transform these memories into maps and words. They were introduced to the Japanese form of Haiku poetry. The group used this technique to create evocative poems based on things observed in the Garden.

Strong firm tower
Green river
Bold archway

Sparkling fountain
Clean air
Church bells

Extract 1 Haiku written by Ruth. June, 2005

The visual artist worked with the participants to encourage the use of new materials and to lend technical advice as well as encouragement and praise. The group was initially resistant to developing their own work at home. The artist and reminiscence worker then suggested a theme that the individuals could respond to in their own time (the activity was not compulsory). They were encouraged to respond with a mixture of text and images. The group found it useful to respond to a particular theme. One participant whose first language was not English was encouraged to write in her native language.

In our eyes the project was successful. We encouraged new people into the Garden and they grew in confidence with the skills that they learnt from the artist and reminiscence worker. People found their own "voice"/modes of expression, trying new techniques, learning from one another and yet gaining in confidence as individuals. Several of the participants were keen that the group be repeated. We have been able to offer the activity again in 2006 with a grant from Oxford City Council's Arts Development Fund. It does not take huge resources to run a project like this. The biggest expense is to employ an artist and a reminiscence worker. With a modest amount of materials a creative activity can be offered to older visitors.

Technically the group became much more confident in their drawing and creative activity. Some developed a critical awareness of their own work. One participant was able to see that her later paintings had become much looser. She no longer felt she had to draw the whole herbaceous border but instead was brave enough to select one group of plants that interested her. Other participants became confident using words to create pieces of creative text and poetry. Our planning had to be flexible enough to let the group say what they wanted to achieve and to deliver some of their needs that we hadn't originally considered. We hoped that the Botanic Garden would not just be a site to hold the sessions, but would become a catalyst for ideas and memories. There was a desire for participants to enjoy and engage with the space around them. Certainly some participants developed a strong link with the Garden.

"(Drawing) enables the visitor to become part of the place and the place to become part of the visitor's experience" (Adams 2006).

The season tickets allowed participants to come and visit the Garden when time allowed. We saw them at festival days, enjoying activities and relishing quiet Sunday mornings. We were touched by the strong attachment and with the high regard in which they held the Garden. It wasn't just a park or a beautiful garden to them. It held something extra for them. It was their magical space. Some of the group went on to seek out more in-depth drawing sessions where they received more formal training in drawing. The Botanic Garden courses gave them the confidence to progress to the next level.

The future

Some of the participants have signed up for the course in 2006. We hope that these more experienced students will take new participants 'under their wing', using skills and knowledge they have learnt in the first year's project to enable new participants to develop.

Image 2 The last session. August, 2005

Conclusion

Overall the project reflected life. It encountered the happy things that happen in life and sad things that life can throw up at you. As a group we managed to support people through sad times and as a group we enjoyed the happy times and learning together. The Garden was used to its full potential to engage the group. The allure of a beautiful space brought participants to the project. The skill and care of the visual artist and reminiscence worker enabled their development and the participants learnt to enjoy the Garden and to treat it as their own. We turned a group of people who had never visited the Garden before into regular visitors.

The success of the project was recognised by The Campaign for Drawing. Information about other projects using heritage sites can be found in their publication, Drawing Attractions (Adams 2006).

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Extract 1 Haiku written by Ruth. June, 2005. Copyright Ruth Hoare.

Image 1 Participants sketching in the Botanic Garden. May, 2005. Copyright Emma Williams

Image 2 The last session. August, 2005. Copyright Emma Williams

Real plants, real tools, real science: Building a conservation ethic through botanical exhibits

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Introduction

At the same time that issues of science and conservation become increasingly critical in public debate, virtual experiences are competing with real ones, and people are growing progressively more alienated from nature. One result of this alienation is that despite the vital importance of plants, people know very little about them and generally cease to notice them in daily life. Wandersee and Schussler (1999, 2001) coined the term "plant blindness" to describe this lack of awareness and understanding of plants. Although exhibitions in many science centers and related venues seek to illuminate botanical concepts, few employ real plants to convey the information. Even botanical gardens regularly rely on models or other abstractions in their educational programs. Yet, botanical gardens are in a unique position to offer direct experiences with plants and the natural environment. People, after all, come to gardens to be close to nature. However, few public gardens take full advantage of the educational potential of their collections.

At the Huntington Botanical Gardens, in San Marino, California, we practice a basic tenet of environmental education that people must develop basic awareness and knowledge of a topic before they can then develop positive attitudes and take actions related to the subject (Stapp, et al. 1969). The more they comprehend the complexity and beauty of the natural world, the more they will appreciate it. Hands-on investigations ranging from viewing stomata under a microscope to measuring the acid levels in pitcher plant juice pull visitors into direct, visceral, and exciting experiences with plants. We believe that these experiences are a prerequisite to a greater public understanding and valuing of the plant world, and ultimately, a stronger conservation ethic.

In this paper, we will present strategies for promoting visitor engagement and understanding through botanical exhibits. We will share successful and less successful interpretive elements; how the public reacted to those exhibits; and how gardens may begin to promote people's positive feelings about plants and the conservation of biodiversity through interactions with real plants, real tools, and real science.

Conservatory for Botanical Science

The Huntington Botanical Gardens, a 103-year-old estate garden of more than 200 acres, is still growing into its educational mission. In 2005, the Huntington opened a Conservatory for Botanical Science aimed at families with children between the ages of 9 and 12. By choosing this target audience, we saw an opportunity for children to have a positive experience with science and nature at a critical age. The focus reflects both the United States' *National Science Education Standards'* (1996) emphasis in grades five through eight on the structure and function of living systems, and the diversity and adaptation of organisms, and the *Science Content Standards for California Schools'* (1998) seventh grade focus on life sciences. Furthermore, the middle school years those during which a child makes the decision to either "like science" and take more science classes in school, or avoid it altogether (George 2000). Positive experiences

with science-related activities such as those offered in the Conservatory can build the confidence and skills a child needs to pursue an interest in science, biodiversity, and conservation.

The Huntington's Conservatory is a 16,000 square-foot steel and glass building with a central rotunda and two symmetrical wings. Three of the four galleries feature habitats: North American coastal bogs, pantropical cloud forests, and pantropical lowland rain forests. In the fourth gallery, the Plant Lab, collections highlight the diversity of plant parts, including roots, stems, leaves, flowers, seeds, and spores. More than seventy exhibits are located throughout the structure, with about half of them in the climatically moderate Plant Lab. Exhibits and plants are integrated, giving visitors the rare opportunity to interact directly with living collections.

Real plants

This project takes full advantage of its greenhouse setting by using real plants in exhibits wherever possible, rather than models or other representations. We feel that real plants have the strongest possible cognitive and affective impact on visitors, and are the strongest antidote to "plant blindness". With this criterion in mind, we limited ourselves to topics that visitors could observe directly from plants during their visit.

For example, one exhibit using living plants is about carnivorous tropical pitcher plants, *Nepenthes*. The exhibit's objective is to show how the plant digests insects, so staff and volunteers gather juice from the pitchers for use in the exhibit. Visitors compare the acid level in pitcher juice with that of purified water using pH meters affixed to exhibit tables. *Nepenthes* growing in hanging baskets and in the ground surround the exhibit. Through examining authentic pitcher juice, complete with partially digested insects, visitors connect the carnivorous habits of the plant to the digestive juices in its pitchers.

> "I thought it was cool, because like I don't see a plant [*Nepenthes*] like that everyday — that digests a bug." — Female, 5th grader (RK&A 2004)

Another successful use of living plants in an exhibit is one focusing on stomata. Rather than make a large investment in a photosynthesis exhibit that would, for example, show changes in oxygen levels within a closed chamber holding grass, we decided to feature the visible structures that plants use in photosynthesis. After some searching, we discovered that the common houseplant *Tradescantia zebrina* has large stomata surrounded by green guard cells within a field of purple epidermal cells. They are quite spectacular under magnification. By viewing a leaf section through a compound microscope, visitors are able to see the actual structures used for gas exchange in a living plant. The leaf section is under the microscope, and living zebrina is on the table and planted nearby. This exhibit has the advantages of highlighting exciting new aspects of a familiar plant, making an abstract concept concrete, being relatively economical, and featuring an easily purchased and cultivated plant.

To be sure, not everything can be shown with living plants. To illustrate phenomena that are too quick, too slow, too small or too difficult to demonstrate live, we selected short video clips. We have videos showing growth, pollination, seed dispersal, and the actions of various carnivorous plants. The intent of using video was not to draw attention away from the living plants, but to help visitors see them with new understanding.

Real tools

During early testing with our target audience, we learned that children appreciated using authentic scientific instruments. They were eager to spend long periods engaging in activities such as measuring the sugar level in nectar samples with a Brix refractometer. Rather than becoming distracted by the tool, students reported that they were surprised to learn that flowers had different kinds of nectar (RK&A 2003). With minimal armoring, we were able to set up an exhibit consisting of: three nectar samples; three vases of corresponding flowers; boxes of tissues for cleaning; and tethered refractometers. This became one of our most successful exhibits with visitors spending a median of almost 3 minutes at the exhibit and expressing understanding of the main message: different pollinators prefer nectars of different sugar levels (RK&A 2006).

It remains an important project goal that the tools be used to enhance observation and understanding of the plants, rather than become an end unto themselves. One exhibit we are still evaluating in this regard uses an underwater camera for examining the underside of aquatic plants. Currently we have tropical water lilies in a pond with an acrylic wall. Visitors can view the plants through the clear wall or with the aid of the camera. The camera is controlled with a joy stick so younger visitors seem to find it compelling, although we are less certain that use of the technology is creating a deeper understanding of the organism and its adaptations to aquatic life. We recently replanted a giant Amazon water lily and will evaluate the exhibit to learn if visitors now use the camera to examine the lily rather than manipulate the camera for its own sake.

Sometimes the tools can be quite simple. During one evaluation session, we asked students to use and comment on an exhibit about flower parts (RK&A 2003). The prototype exhibit consisted of cut flowers in a vase, and labeled, scanned images of flowers. The activity was to identify and count the flower parts. The students rightfully pointed out that they were not motivated to do that. They said it was “too much like school” and that they did not see the point in the activity. Our content focus was reproduction, so we simply added a dry paintbrush and asked the students to move the pollen to the stigma, to pollinate the flower, just as is done in the field and nursery. Suddenly, there was a reason to know what the reproductive parts of the flower were and how they worked. We later added a videoscope and monitor so that visitors could see this process more closely, but a hand lens would work as well.

Real science

Our third project goal was for visitors to build scientific skills and confidence. In order to incorporate the practice of science into the exhibits, we asked ourselves what visitors would do at each exhibit, rather than what they would learn. This filter helped us to eliminate many ideas, and to focus the remaining ones. As a result, exhibits encourage visitors to engage in the practice of science – to touch, smell, observe, measure, and compare.

One straightforward method of encouraging visitors to engage in observation was to create flipbooks that describe the trapping and digesting methods of carnivorous plants. The plants themselves are located adjacent to these flipbooks and each comes with a tethered magnifying lens. A similar exhibit asks visitors to identify orchids that mimic insects. The orchids are growing on a tree overhanging the exhibit, again accompanied by magnifying lenses.

Measurement is the main activity in another exhibit where visitors compare two 5-gram samples of *Sphagnum* moss. A lightweight plastic basket holds each sample. The dry sample is sealed in

a plastic bag to prevent it from taking on water. The wet sample has no bag, but is free to absorb water. The length of basket handle compensates for the slight difference in weight between the samples. Visitors dip the wet sample in a basin of water and weight it on a waterproof scale. They then compare the weight of wet sample to the dry one. A close up image of *Sphagnum* cells on the main label shows the hollow cells that give the moss its unique water-holding character. In this way, visitors gather their own data from real samples of moss and learn that "wet moss weights a lot more than dry, because moss soaks up a lot of water" (RK&A 2003).

Impact

We conducted evaluation throughout the process of exhibit development; testing prototype exhibits with the target audience, visiting public, and museum colleagues. Altogether, formative evaluation included approximately 250 people. Summative evaluation included exit interviews (of 100 visitors) and focused observations with interviews (of 79 visitors). About two-thirds of Conservatory visitors could give specific examples of how they engaged in science during their visit. They mentioned using the scientific tools, practicing scientific skills, interacting with the collections, and the general assemblage of exhibits.

While nearly all exit interviewees said they had a positive attitude toward plants before they visited the Conservatory, one third said they had a heightened appreciation of and respect for plants after the visit. They had gained insights through experiencing new habitats, viewing new species, and learning about plants' habits and characteristics.

> "I learned all about plants — where they come from and how they live — so that makes me respect them more." — male, 50 years (RK&A 2006)

In summary, gardens can counteract visitors' "plant blindness" through offering them real plants to see, and real tools and real science to help them understand those plants. Seeing and understanding are the first steps toward developing a conservation ethic.

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Biographies

Karina White has been developing botanical exhibits and programs for nine years. Before coming to the Huntington, she worked at Descanso Gardens and the Brooklyn Children's Museum. She has an architecture degree from UCLA.

Kitty Connolly has eleven years experience developing exhibits and programs for the Huntington Botanical Gardens and the Smithsonian Institution. She recently joined the board of the American Public Garden Association.

Advances in research towards a theory of plant blindness

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Prologue

The invitation to speak on September 12th, 2006 at the 6th International Congress on Education in Botanic Gardens, hosted by the University of Oxford Botanic Gardens, provided us with a new opportunity to share some research-based advances in our *theory of plant blindness* with a worldwide audience of botanic garden educators. We are indeed grateful for the chance to describe, albeit briefly, our progress in theory building, and to suggest some possible applications of the theory for informal science education at arboreta, nature parks, and botanic gardens.

Since 1989, the first author's visual cognition research laboratory (15° Laboratory) at Louisiana State University has been studying public and student understanding and awareness of plants. Key topics of investigation have included improving visual approaches to learning photosynthesis, the carbon cycle, rhizobotany, and what it means *to teach the whole plant*—a challenge set by the Botanical Society of America in its turn-of-the-century vision statement entitled: *Botany for the Next Millennium* (Niklas 1995).

Toward a theory of plant blindness

After several years of interviews, library searches, and small-scale investigations, in 1998 our laboratory coined the term *plant blindness* and introduced it to the fields of biology education and botany education (Wandersee & Schussler 1999; 2001). We defined *plant blindness* as failing to see, take notice of, or focus attention upon the plants in one's everyday life. Subsequently, we have elaborated upon this definition, including the addition of supporting characteristics and symptomatic behaviors.

Simultaneously, we proposed a default human visual processing explanation for the public's lack of attention to and interest in plants, as exhibited in industrialized and post-industrialized nations such as the US, based on visual cognition research. Our primordial theory of plant blindness was set forth in Wandersee and Clary (2006) and Wandersee and Schussler (1999; 2001). The first and third sources cited here are also accessible online.

We undertook this intellectual project because we thought that the current state of inattention to and under-representation of plants—not just in biology instruction, but in informal science education settings, and in US society in general—might be better explained by using research-based principles of human perception and visual cognition than by earlier instructional-bias and deficiency-related hypotheses found in the botany education literature—such as zoocentrism, zoochauvinism, and plant neglect.

Why a new term?

Why coin a new term? We wanted the term *plant blindness* to be free of what we considered to be accumulated and inappropriate connotations which the prior three terms possess, and to serve as a precursor term, signaling visual cognition explanations for some of the resultant learning-related problems. We cringe at the occasional contemporary misuse of all four terms in the literature, as though they were co-equal and synonymous. We see this as both dismissive and retrogressive. We argue that each term-- zoocentrism, zoochauvinism, plant neglect, and plant blindness--has a different embedded, underlying explanation. We share with Fisher (2001) the view that clarification of terms is a key step forward in advancing critical thinking.

In challenging the conventional wisdom, we have proposed that those first three behaviors (zoocentrism, zoochauvinism, plant neglect) are actually *symptoms* of the default *condition* of plant blindness (arising from how the human eye-brain system typically processes and attends to visual information), and thus are not foundational, causal explanations for the public's inattention to plants.

Identifying plant blindness

We have found that persons afflicted with the condition known as plant blindness may exhibit symptoms such as the following: "(a) failing to see, take notice of, or focus attention on the plants in one's daily life; (b) thinking that plants are merely the backdrop for animal life; (c) misunderstanding what kinds of matter and energy plants require to stay alive; (d) overlooking the importance of plants to one's daily affairs (Balick & Cox 1996); (e) failing to distinguish between the differing time scales of plant and animal activity (Attenborough 1995); (f) lacking hands-on experiences in growing, observing, and identifying plants in one's own geographic region; (g) failing to explain the basic plant science underlying nearby plant communities—including plant growth, nutrition, reproduction, and relevant ecological considerations; (h) lacking awareness that plants are central to a key biogeochemical cycle—the carbon cycle; and (i) being insensitive to the aesthetic qualities of plants and their structures—especially with respect to their adaptations, coevolution, colors, dispersal, diversity, growth habits, scents, sizes, sounds, spacing, strength, symmetry, tactility, tastes, and textures" (Wandersee & Schussler 1999).

Delimiting the theory of plant blindness

We also found the theory of plant blindness applies primarily to industrialized or post-industrialized societies, to urban and suburban settings, to those persons lacking a *Botanical Sense of Place* (Wandersee, Guzman, & Clary in press), and to those who have what Louv (2006) has called a *nature-deficit disorder*. The latter two factors are primarily personal and experiential, and highlight lives lived apart from plants.

How prevalent might plant blindness be? People are losing contact and experiences with agriculture and with nature. In the US of 200 years ago, 90% of the population farmed; now less than 2% of the population farms (National Council on Economic Education 2006). Half the world's population will live in cities by the end of 2006, up 30% from 1950; and this figure doesn't even include all the people living within what are called "very large urban areas" (UN Commission on Population 2005).

Some research-derived visual principles that help to explain plant blindness

1. Norretranders (1998) has calculated that only .0000016 of the data our eyes produce are actually considered consciously. It seems that visual consciousness is like a spotlight, not a floodlight. By default, if plants are not an aid or a threat to survival, they are less likely to receive conscious attention via search imaging.
2. Plants can and do modify their visual signal values in accordance with the survival values conferred. Thus, they may appear more prominent at certain times of the year.
3. Mack and Rock (1998) have found that once objects have acquired meaning for an observer, they are more likely to be consciously perceived via vision. Inattention can become attention, once an object or event has acquired personal meaning.
4. Vision is anthropocentric—we pay more attention to human faces than anything else. Studies also show that people, being animals themselves, pay more attention to animals than to plants, even though, paradoxically, plants form the basis of most animal habitats and all life on earth (Abbott 1998).
5. To see an object in one's visual field, it is necessary to attend to it. Looking is not the same as seeing. We pay little attention to things that have little meaning for us. Solso (1994, p. 26) notes "…we gaze longer at interesting or puzzling things…."
6. The brain uses patterns of space, time, and color to structure visual experience (Zakia 1997). Because they are immobile autotrophs, plants in nature generally offer fewer spacing-based, time-based, or color-based visual cues for humans to observe than animals do—except, for example, during periods of pollination and dispersal (cf. Wandersee & Schussler 2000).
7. Gopnik, Meltzof, and Kuhl (1999, p. 65) claim that: "Paying attention to edges is the best way of dividing a static picture into separate objects." Plants often grow close together in populations, and thus have chromatic and spatial continuity. This makes it hard to see structural edges, and individual plants do not "pop out" from their background.
8. Humans can only focus on one thing at a time. Attention is a zero-sum game. Brightness, low color contrast, and lack of shadows under daytime lighting conditions make plants less conspicuous, minimizing optic flow, except near dawn and dusk
9. Human attentional capacity is idiosyncratic, and it also decreases with increases in drugs, alcohol, fatigue, and age.
10. Too many kinds of plants can seem overwhelming to consider—in one study, a maximum of 6 different visual choices was found to be ideal for viewer satisfaction, rather than arrays of 24 or 30, based on the research of Iyengar and Lepper (2000).

Research-derived implications for preventing and remediating plant blindness

Some of our most robust and hopeful findings, based on three national studies and numerous site-based studies in the US and abroad, include:

1. The presence of a plant mentor earlier in a one's life (someone who helped the mentee observe, plant, grow, and tend living plants) is a key predictor of that person's awareness, appreciation, and understanding of plants throughout the lifespan.
2. As the practical value and degree of importance a person self-ascribes to the Plant Kingdom and its members increases, *plant blindness* decreases.
3. Lesser recognized but powerful interest generators that can help mitigate plant blindness include experiencing living plants, in context, that are food sources, or, that have ethnobotanical or contemporary medicinal applications.

4. Displays of what we have called *marquee plants* can increase garden and arboretum attendance. These plants represent selected specimens that have the ability to draw a crowd because they are the oldest, largest, smallest, widest, most massive, rarest, most odiferous, rarely blooming, and so forth. Unless highlighted in publicity and interpreted with gusto, visitors often walk by these without any sense of wonder. Every botanic garden has more potential marquee plants than it realizes. We have evidence that marquee plant experiences which increase one's perceived "sense of wonder" diminish plant blindness.
5. The plant-related experiences a mother will provide for her children can be predicted by her own plant-related experiences and by her own self-reported awareness of the presence of plants in her life.
6. As a person's experience and proficiency in using a carefully chosen taxonomic key and magnifying lens to compare, contrast, and identify plants increases, plant blindness decreases.
7. The more senses explicitly involved in a visit to an arboretum or botanic garden, the more memorable the visit, and the greater the impact of the visit toward alleviating plant blindness.
8. Providing garden visitors with paleobotanic (deep-time) interpretive perspectives and opportunities to see and touch actual plant fossil specimens related to the living plants that they are viewing (such as leaves and petrified wood) increases total viewing time, as well as attention to, and appreciation of plant evolution and plant diversity in living garden collections. Plants have a past! Plants are members of families! These temporal and phylogenetic dimensions are seldom explained or interpreted (Clary & Wandersee in final review). History…illuminates reality, vitalizes memory, …and brings us tidings of antiquity.—Marcus Cicero, ca. 44 BCE.

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Biographies

James H. Wandersee, botanist, and Renee M. Clary, geologist, are co-founders of the EarthScholars™ Research Group. They do university- and field-based visual cognition and archival research aimed at improving and integrating biological and geological learning. A principal goal is to improve public understanding of these two sciences on natural trails and at informal science education sites, specifically—arboreta, botanic gardens, fossil parks, nature parks, and public caves.

Undergraduate education at the University of Oxford Botanic Garden

Timothy Walker

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Whenever conservation workers meet to discuss progress towards the targets of the Global Strategy for Plant Conservation (GSPC) someone is bound to say that no one is teaching plant identification and classification any longer. I would challenge this on two grounds. Firstly, many UK universities, including Oxford, are teaching systematics and field botany including the use of keys to identify plants. Secondly, I do not believe that more than a handful of people ever get into plant identification at school. Like it or not, most normal people develop their interest in plants after their adolescent hormones have finished looping the loop. Certainly most of us in professional horticulture learnt our first gardening with a parent or grandparent but they taught us how to grow vegetables, not how to distinguish *Euphorbia villosa* from *Euphorbia palustris* (like anyone cared).

However, this does not mean that all is well in the teaching of botany in universities. The thoughts & suggestions detailed in this paper have been accumulated during the past 30 years as both an undergraduate and lecturer.

The first problem is the word "botany". It is just not a word that most people use; zoology is one thing but botany is quite another. This means that if you want to sell the product you don't call it botany; Biological Science, Environmental Biology, Conservation Biology, even Geography but not botany. The problem is exacerbated by the fact that botany is not a word used in schools. In fact, plant is not a word used in most secondary schools. Most biology teachers now in UK schools are zoologists or molecular biologists. They are not comfortable teaching any plant science except for photosynthesis. While the antics of ribulose-biphosphate carboxylase are rather important, it is more chemistry than biology. It is now possible for "A" level (pre-university) pupils to avoid plants totally. Even the teaching of genetics avoids mention of Mendel and his peas. There are more references to plants in General Studies where the Convention on Biological Diversity is mentioned.

There are number of things that botanic gardens can do to mitigate the avoidance of plants at schools; either you go into schools or you invite the schools to visit you and in reality you do both. At the Garden we employ a secondary schools education officer in a joint appointment between us and the University Museum of Natural History. The advantage of this is that the teachers see Museum of Natural History and think animals and are therefore not put off from coming. You can offer programmes on conservation, genetics, ecology, evolution or whatever and they come; offer botany & no-one comes. Once the pupils are on the programme then for the first time they are exposed to plants by people who are passionate about plants. Going into schools is also a very easy way to reach a lot of pupils. Many schools teach general studies to all of their 17 & 18 year olds. The advantage of this is that you get to all the pupils including those who are not scientists. Even non-scientists need to know about plants.

The next important stage is to encourage the pupils to apply to study at your university. This takes a lot of time but there is a great deal of competition between universities and no university can assume that they will receive applicants. Open-days are the standard ways of recruiting potential students. University botanic gardens must be involved at this stage with displays and preferably with garden staff. Mock tutorials or classes are a very easy way of engaging with those attending open-days. If at all possible garden staff should be involved in the selection process and interviews.

It is essential that garden staff are involved in the teaching of biology at universities and therefore are on the teaching committee for the course. Garden staff should be involved not only as lecturers and practical demonstrators but also as module coordinators and option organisers. If at all possible the undergraduates should visit the garden in their first week at university. Again this may be the first time that they have been shown how truly wonderful plants are. This is not the time for an explanation of the basis of the Angiosperm Phylogeny Group's Ordinal Classification of the Angiosperms. Instead this is where you show them that plants underpin everything that we do. Show them medical plants, crop plants and any other plants of which they may have heard and lead from this into conservation. This story telling is an extended version of what we do with primary & secondary school groups.

When the undergraduate start their lectures that is the time to start teaching them hard-core plant science like the major groups of land plants, plant reproduction, pollination, seed biology and plant propagation but at every stage you must relate this to a practical issue. The easiest and the best practical issue to choose is plant conservation and especially habitat management. If there are others teaching whole plant biology then encourage them to use the garden and its plants as demonstration material; the zoologists can only show pictures but we can use the real thing.

In the second year our undergraduates can choose three of five options in addition to compulsory modules in Statistics and Evolution & Systematics. The Garden can obviously contribute to the environment/conservation option and the plants option and in some cases to the other options in developmental biology, disease and even the animals course. In the conservation option the Garden runs one of the eight lecture modules and so has total freedom on the content. The syllabus for this is essentially the targets of the GSPC. In addition, the Harcourt Arboretum is used as the venue for a practical demonstration of both *in situ* and *ex situ* conservation techniques and programmes. The beauty of the Garden organising this module is that the conservation work of botanic gardens worldwide can be used as a very positive and productive example of work in progress. We must bang our drum because no one else will. The Garden can also contribute to the teaching of contemporary issues in plant biology such as biodiversity assessments and plant classifications.

By the third and final year we will have lost some of the undergraduates because they only need to do two options. However, they all have to complete a small research project and this has been a very useful way of carrying out research into the conservation biology of our English bluebells at the Arboretum, a species recovery programme for *Euphorbia stygiana* and plant diversity assessments of our woodlands and meadows at the Arboretum. Student projects are a very good source of bright, motivated researchers who are free.

For those continuing with plants into the third year, the first module is a two week field trip to the western end of the Algarve. This is the most wonderful place to teach field biology and we have always been made to feel very welcome by the Portuguese authorities. In the first week the undergraduates learn how to identify plants in the field, to build keys and how to classify plants at species level. In the second week they look at how the plant communities function, particularly

in terms of their reproductive biology. Each evening there is a lecture that either compliments the day's field exercises or previews the following day. The undergraduates always work very hard during this intensive fortnight and the course questionnaires are always very positive. One undergraduate reported that he "had not learnt so much, so quickly & so pleasurably since his first serious girl friend."

Later in the third year the plants undergraduates can take modules in angiosperm systematics and in the morphology of phylogeny of seed plants. These two modules call extensively on the Garden & Arboretum. The latter module consists of eight one-day sessions that builds on and reinforces the skills learnt on the field trip. Meanwhile, the undergraduates who have kept up the environment/conservation option look in more detail at topics such as conservation genetics and the ethics & politics of conservation.

The final chapter in this story concerns the fate of the undergraduates; do they go on to pursue a career in conservation? A significant number do. Both the UK and Irish GSPC co-ordinators went through this University. The three previous directors of Kew were also Oxford graduates. Other undergraduates have recently gone on to work in taxonomy and conservation projects abroad. In my experience there is not a lack of appropriately trained graduates if, and only if, you accept that education is now a market place and that we have to work hard to attract students to our courses.

Ten points for including botanic gardens in the education of undergraduates - T15 of the GSPC:

1. Get out into schools to evangelise about plant conservation.
2. Always get involved in open days for sixth-formers.
3. Accept that sixth-formers & teachers can avoid plant biology at school.
4. Get the botanic garden on the course teaching committee.
5. Get the students into the Garden in week 1.
6. In Year 1 open their eyes to the practical use of plant biology.
7. In Year 2 teach them the basic of plant conservation including GSPC focusing on what BGs do worldwide.
8. In Year 3 take them into the field, then bring them into the Garden & Arboretum.
9. Use the garden's work as an example of what individuals can do – don't be modest.
10. It doesn't matter what the course is called so long as it is not botany.

Connecting people to plants: Botanical messages that make a difference

Dr. Lisa K. Wagner

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Think back to when you first discovered the fascinations of plants. Did you wake up to discover a new shoot from a recently planted seed or a ripe tomato ready to harvest? Or, did you notice clouds of butterflies visiting flowers in a nearby garden? Perhaps you were walking along a rural road, or playing in a vacant lot near your house, or spending time with a favorite relative in the garden. Opportunities to discover plants are everywhere, since plants inhabit such a wide range of habitats.

By encouraging people to connect to plants, to translate the "green blur" into a community of trees, shrubs, and herbaceous plants, we make the world of plants come alive for our visitors and program participants. Key to this translation is the process of making what is familiar, fresh and unfamiliar, as suggested by Tim Grant of *Green Teacher*. The 'aha' moments that suddenly give new light to a familiar subject are those that remain with us, and encourage new observations and questions. I remember quite clearly leading the Grocery Bag Botany activity from *Project Seasons* for the first time, and having my own discovery moment, when oatmeal was transformed from a familiar childhood cereal to a "flattened seed" eaten with shriveled fruits (raisins). I had never considered oatmeal in quite that light before.

All of us share a passion for plants, and as an educator, I've learned to appreciate the power of simple messages and experiences. Consider pollinator visits to flowers, for example. Encouraging teachers, college students, parents, and children to observe flowers and their visitors more closely (before "telling" them about pollinator syndromes or floral morphology) has elicited responses from "wow, I had no idea that flowers were so interesting" to "I always hated science before, but this is great." Sometimes what we don't say is more important that what we do say; "plant a question, watch it grow" is the suggestion of another outstanding K-12 curriculum guide, *GrowLab*: *Activities for Growing Minds*.

Botanical messages that capture interest and "work" to connect people to plants are an essential part of an effective communication strategy to advocate for plants and their conservation. Our visitors and program participants often take the green world for granted, noticing first the movement and activity of birds, insects, and other animals, before seeing the details of plants and vegetation. By encouraging people to look more closely, highlighting the ecological roles of plants, and posing meaningful questions, we can help people discover the world of plants and their fundamental importance.

In programs, presentations, and written interpretation, I've found that key points are best served by simple messages and an engaging approach. Short captions, "hooks," and visuals that tell a clear story make the difference between a panel that people stop and read and one that is ignored. By making connections between what people know, and what we want them to understand, we can effectively capture their interest and stimulate reflection and thought, essential for a satisfying learning experience.

Phrases and questions can help focus interpretive messages. In her book, *Plants for People*, Anna Lewington employs this technique successfully. For example, one heading 'Are you wearing Chinese nettles?' introduces a paragraph on ramie and another 'Cosmetic colour - plants that send messages' begins an interesting discussion of the historic uses of plant waxes, oil, and extracts. Vivid and direct language brings home the importance of your messages. Borrowing an advertising slogan, I've used the phrase 'Have you thanked a plant today?' as a title for a presentation as well as a way to begin an interpretive display panel focused on plant uses.

Effective interpretation can be related to all of the areas in which people are intertwined with plants, from food, clothing, and shelter to healing. Plants that have stories provide an entree to engage an audience, capture a reader, or interest a child. The remarkable stories of our food plants and their worldwide diversity are an obvious way to connect to anyone who has ever eaten a tomato, a banana, or drank a cup of coffee. Thinking about the sources of the plants that we eat, and their increasingly global origins, stimulates reflection on the diversity of cultures and growing conditions around the world. The origins of natural fibers such as cotton, linen, and ramie, are equally fascinating, with stories of their own. Similarly, plants used for medicines and healing have global interest, with diversity and cultural paths interwoven with their botanical characteristics.

Showcasing the richness of our collections is another way to provide an alternative to the often dull offerings of traditional botanical teaching; compare a close-up look at a hairy petunia flower or the remarkable staminal columns of a spiderwort, for example, with the large, but unremarkable parts of a florist gladiolus. In a recent article, "Boring Botany? Rethinking teaching about plants in schools," Dawn Sanders makes this point by referencing some of the botanic garden resources that are particularly interesting to children, including carnivorous plants, odiferous plants, and 'spiky' plants, as well as plants that have cultural uses and historic significance.

Some of the phrases that I've successfully used encourage people to think about plants as part of an overall natural community. As an advocate for wildlife habitat gardening practices, I like to talk about 'plants that work for a living' - to characterize the contrast between ornamental landscape plants that just 'sit there' with plants that produce abundant nectar and/or pollen, serve as a food source for caterpillars, or provide nesting habitat. I also like to promote 'creating a garden that's full of life' extending the idea of gardening to taking care of everything that lives in a healthy garden.

We have a wonderful opportunity as botanical garden educators to encourage our visitors and program participants to discover the amazingly diverse world of plants in our gardens and programs. In the process, we can hopefully stimulate their interest in plant diversity and conservation.

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Biography

Lisa Wagner is a plant ecologist and naturalist, with professional interests including informal science education and sustainable gardening. She works with people of all ages to inspire their interest in plants, animals, and the natural world.

Sixteen years of cycad propagation in rural nurseries in Mexico: An alternative conservation strategy aimed at sustainable management

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Introduction

Propagation of threatened native plants at the Jardín Botánico Francisco Javier Clavijero (JBC) has been on going since its foundation in 1977 with emphasis on native species. The cycad collection began in the late 1970's and established as a national collection in the 1980's and ongoing research on this group of plants has been in process ever since (Vovides et al. 1995, 2003). Extension to rural communities has been made for the propagation of cycads. We answer questions such as; how were the farmers convinced to cultivate the cycads? How were they taught? What problems were encountered? What was their reaction? What outcome and follow-up is there?

Historical background

Cycads in Mexico are subject to collection from habitats for the horticultural trade (Fig.1), and are now considered priority for conservation by the authorities. However, habitat destruction, forest fires and changes in land use are still a continuing problem. Illegal collecting still occurs at the national level, especially the beheading of wild adult plants of *Dioon edule* and *D. merolae* and crowns sold in major Mexican cities (Fig.2).

Fig. 1. Illegally collected *Zamia furfuracea* Photo: Dennis Stevenson

Fig. 2. Decapitatied leaf crowns of *Dioon edule.* Photo: G. Alanis From Vovides et al., 2002

Based on a previous demographic studies (Vovides 1990) and germination trials on *D. edule* at the JBC an in situ rural nursery was started at Monte Oscuro, Veracruz during 1990 and peasant farmers encouraged to propagate the cycad (Vovides & Iglesias 1994). This has created ownership value of the resource by means of plant sales, and in turn the farmers protect the habitat as their seed source. Experimental plant reintroduction has occurred. This alternative conservation strategy has since then been repeated in two biosphere reserves in the state of Chiapas for the propagation of four additional cycad species; *Ceratozamia mirandae, C. matudae, Zamia soconuscensis and Dioon merolae* (Pérez-Farrera et al. 1999; Pérez-Farrera et al. 2000; Vovides et al. 2002) and more recently in a biosphere reserve in the state of Puebla for the propagation of the critically endangered *D. caputoi*.

The nurseries are registered with the authorities allowing the farmers to collect seeds from the wild for cultivation and sales in nurseries called UMAS (acronym for Unidad de Manejo de Vida Silvestre = unit for wild-life management). The *Dioon edule* nursery at Monte Oscuro is the first of its kind in Mexico and precursor to the concept of UMAS for plants, now an official system within the Mexican authorities since the mid 1990s. Later a similar approach was used in farming communities in Chiapas for *D. merolae*. These nurseries contribute in removing collecting pressure off the wild populations and at the same time offer an alternative source of income to the local economy of the producers

How were the farmers convinced?

The nurseries were created on the premise that; i) abundant seed is produced in the wild ii) the majority of habitat germinated plants and seed perish during the first dry season; iii) rodents also predate seeds iv) germination trials showed 98% germination rate within two months of sowing ripe seed and v) cultivation of plants in or near situ to the natural populations does not present any serious management problems and a minimal infrastructure is required. (Vovides 1990; Pérez-Farrera et al. 1999). Farmers that were willing to participate in the project were invited to the JBC for a tour of the cycad collection and later more formal workshops in basic nursery and horticultural practice were given to the producers at Monte Oscuro and those of the Biosphere reserves in Chiapas and Puebla.

How were they taught?

It was not difficult to introduce these subsistence farmers into basic nursery practice by using available materials (Figs. 3, 4). They have also combined their traditional knowledge thus improving and adapting to their needs the many aspects of technical practices that were taught. Illustrated talks on basic cycad biology were given so that they could recognize male and female plants, pollinators and pollination periods as well as insect pests in the nursery. This was backed up by hands-on practical work in the field like being taught how to recognize ripe seed from cones. Techniques such as seed selection and storage were also taught. These practical courses prompted Pérez-Farrera and Vovides (1997) to publish a small booklet for cycad propagation, which cover the essential points of propagation (Fig. 5).

Fig. 3. Rustic nursery at Tres Picos, Chiapas with *Ceratozamia mirandae* Photo M.A. Pérez-Farrera

Fig. 4. Nursery at Monte Oscuro with *Dioon edule* Photo: A. Vovides

Major problems encountered

Continuous assessment by a single person that really believes in the philosophy of the project and can talk on the same level as the peasants is necessary for success. There is a high level of frustration in repeating techniques many times to the same persons and local idiosyncrasies must be considered. Some communities prefer to work in their own back patios, which makes training cumbersome, whilst others have taken up the recommendation to have a centralized communal nursery. The latter system makes training logistics simpler by concentrating materials in one place thus avoiding duplication. In some communities it is the family headmen that participate in the nursery with an absence of women and children, yet in other groups it is the women, children and extended family that participate in the nursery. Here the headmen are concerned with 'more important business' such as cattle and do not take part in the daily concerns of the nursery (Vovides et al. 2002).

Marketing and plant sales has been slow and sporadic which calls for an early establishment of marketing techniques for this type of project, and the collaboration of facilitators in marketing is essential to help the farmers out with permit gestation. Further training is needed produce to quality plants that meet market requirements or collaboration by professional intermediary nurseries. Diversification to include other species will help to avoid overproduction of one single species leading to market flooding and farmer competition for a limited resource (Vovides et al. 2002). The national market is virtually virgin for cycads and is sought for, since these plants are unknown amongst the general public. International markets are also considered but this involves additional paper work with export requirements and CITES documentation for each shipment, all are time consuming.

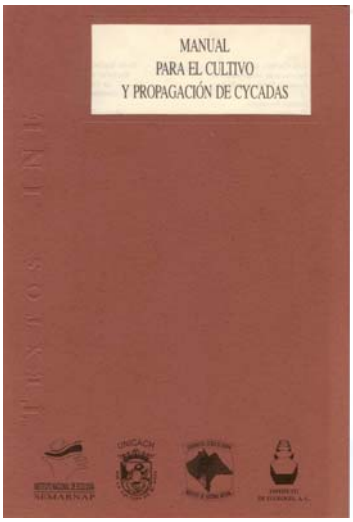

Fig. 5. Cycad propagation manual

Fig. 6. Bilingual (Mazatec-Spanish) booklet on cultivation of *Dioon spinulosum*

What was their reaction?

The biggest preoccupation amongst the farmers is that sale has been slow and sporadic. The farmers have realized that cycads grow slow and are not labour intensive, and also they do not perish, but gain value by becoming older and bigger and this has encouraged continuity. The consensus of opinion has been generally positive amongst all nursery members since the time demand to attend the nurseries is not great and has encouraged continuity. Their response on reintroducing plants into the wild was met by many questions at first but was eventually understood after explanations from the project leaders. Some (Chiapas) were of the opinion that faster growing plants such as medicinal and alternative food species should have been chosen for the nursery project.

Outcome and follow-up

We are all encouraged and impressed by the positive reception of the project amongst the farmers. This has been possible thanks to a mutually cordial exchange of ideas and respect between the peasants and the project technicians, and also the "believing in the project" by the leaders was found to be essential. This was seen in the El Triunfo Reserve, rich in native rain forest, where the inhabitants were sensitized into forest conservation through cultivating organic coffee prior to the introduction of cycad growing. They took readily to the idea to produce local cycads and palms.

Independently of us, assessors of the NGO in Oaxaca CEMASREN have promoted an UMAS amongst a Mazatec indigenous community in northern Oaxaca for the production of *Dioon spinulosum*; the assessors have produced a bilingual booklet (Mazatec and Spanish) on the conservation and propagation of the cycad (Fig. 6).

The impact on the authorities has led to the publication of a national cycad action (INE-SEMARNAP 2000). The municipal parks, gardens and boulevards of the city of Xalapa and private residential estates are now using cycads and other native plants in their landscaping (Fig. 7). This form of extension will contribute to a greater knowledge of the cycads amongst the general public and information is available to schools and libraries through an interactive CD-

ROM on cycads (Gómez-Pompa et al. 1994, 2000), and locally through the cycad collection at the JBC.

In an attempt to answer the marketing problem Cycadáceas Mexicanas (Cycamex) have created a cycad sales point in the municipal garden centre of Xalapa, "Doña Falla". Cycamex is also organizing facilitators to link the more remote nurseries in the biosphere reserves of Chiapas, Puebla and others to the markets (Fig. 8).

In addition, the Instituto de Ecología, A. C. is hosting a bilingual web page to promote the nurseries at national and international level, this can be visited at: http://www.ecologia.edu.mx/cycamex

Fig. 7. *Dioon edule* in municipal landscaping
Photo: A. Vovides

Fig.8. Meeting with producers and facilitators to discuss marketing
Photo: A. Vovides

Conclusions

These nursery activities are an example of education in botanic gardens extended to rural communities and form an important component of an integrated strategy for cycad conservation with an aim at sustainable utilization. This has given incentive to other communities to follow suit and illegal collecting has been discouraged in some areas. These nurseries are in accord of Articles 9, 13 and 18 of the Convention for Biological Diversity (CBD).

Acknowledgements

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Biography

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A new model for environmental education in Argentinian botanic gardens

Helene Vilbert

Dr. Miquel J. Culaciati Botanic Garden, Córdoba, Argentina

Dr. Miquel J. Culaciati Botanic Garden (MJCBG) is located in central Argentina, in the Córdoba Sierras, an area that is renowned for its scenic landscapes, temperate climate and for the rich plant diversity, especially for native species that have actual or potential use as medicinal, aromatic and ornamental plants.

Since 1989, MJCBG has developed integrated educational programmes with local schools and the general public to increase public awareness regarding the conservation and maintenance of native resources, with a special emphasis on medicinal plants and their traditional uses. A BGCI member from 1996, the garden has successfully used the global framework as provided in The International Agenda for Botanic Gardens in Conservation (Wyse Jackson and Sutherland 2000) creating links with universities, in our case with the Faculty of Agronomy of the University of Buenos Aires providing scientific advice.

The general goal in the garden programme is to provide meaningful values based on the Earth Charter (The Earth Charter Initiative Handbook 2002) within the Environmental Education Programme at local and regional levels. The new programme is envisioned to complement the school curricula at the elementary and high-school levels, facilitate college level education in environmental sciences, and provide adequate information to the general public and other stakeholders.

BGCI - Investing In Nature Programme, provided the opportunity to have a new master plan using The Darwin Technical Manual for Botanic Gardens (BGCI 1998) as well as remodeling the Botanic Garden and integrating a Community Cultural Centre with a public library which enhances our infrastructure facilitating the implementation of the new educational programme.

The second issue of our magazine, "Verde y algo mas," has already been completed. 2,000 copies are distributed free of charge to primary schools which are further afield. Download pdf format from our website: www.argentinapeopleandnature.org/english/magazine.

In order to use and test old and new resources with local schools and extend our reach to encompass rural schools, we surveyed 10 rural schools and implemented a comprehensive environmental education programme in a primary rural school in the area. The next stage is to impact on an area surrounding the rural school which has been badly damaged by fires and begin a reforestation programme.

A major effort in education and public awareness needs to be implemented for people to realize and understand the importance of preserving our natural wealth and managing natural populations in a sustainable way. This is especially true in this region where subsistence of many local inhabitants rely on the harvesting of medicinal and aromatic plants from the remnant natural areas.

Our key role is to help through sustainable education, creating awareness and a sense of stewardship for the environment, and the goods and services it provides. Sustainable education should be the driver of future change. It is only through the appreciation of what we have and the understanding of how to exploit it wisely, that we will be able to preserve our assets for future generations. (Willison 2006)

In Argentina the question is what kind of education is psychologically and socially suitable for children of the twenty-first century and beyond. Many young people spend as much time learning in front of a television set or a computer as they do actively learning at school. Some are being conditioned by urban environments devoid of open spaces, plants and animals. Others have not even seen a computer let alone have access to internet. (INDEC)

As a result of urbanisation and the false belief that humans have become virtually independent of nature, our young people are being deprived of their birthright of contact with the natural landscape through physical activities and field studies.

After the First Environmental Education

Congress organised by CTERA, The Union for Educationalists, there emerged within the teaching community an on-going discussion regarding environmental issues and what to do with them.

It is well-known that the transfer of skills, knowledge, or habits of thinking takes place more readily when the original learning is in a setting resembling a real-life situation. (VandenHazel/Benson 1973)

Environmental education therefore should take place in a natural setting. Fortunately, Botanic Gardens are available as teaching aids for most curricular subjects.

However, in the same way as new learning activities and techniques are often introduced in small steps, the environmental education programme could be introduced gradually as each garden has a different set of difficulties for its implementation.

The economic crisis in Argentina has deepened the inequalities, broadening the social gap between those who have access to resources and education and those that live below the poverty line. Córdoba is no exception to this generalized problem, and unemployment in rural areas has accelerated emigration to larger cities, only to join the ranks of urban unemployed. (INDEC)

Through the successes and failures, the programme has obtained valuable skills which have assisted in the implementation of a useful model in the Argentina Botanic Gardens Network. Having been selected to create a model to serve all Botanic Gardens in Argentina has been an incredible challenge. Not only is there an enormous biodiversity in Argentina, but also the socio-economic reality is vastly different.

The Argentinian Botanic Garden Network comprises 39 established members, and others in development, whose operating budgets are minimal and are dependent on universities, and educational or scientific institutions within the public sector.

To create a model skeleton as an adequate guide whereby gardens are able to build their own manual and work together in the development of this tool putting into action a forum to share experiences; for example to discuss the draft index for a new environmental education model.

Index

“A guide to create grassroots strategy for environmental education in Argentinian Botanic Gardens”.

- Introduction
- Background
- Values
- The Earth Charter
- Ten Principles of Good Practice
- A sound relationship with teachers

- Inventory of resources: Games, School sheets, interpretation displays, puppet shows and artistic activities
- Interactive resources available on the internet.
- Integrated community resources, agendas of special events and dates.
- Local Actions
- Monitor and Evaluate
- Fundraising: to sustain new and on-going programmes
- Inventory of problems and suggestions on how to resolve them

Conclusion

It is our objective to assist the Argentinian Botanic Garden Network to achieve the 2010 Targets for Botanic Gardens promoting education and awareness:

- "Every botanic garden to have a communication, education and public awareness programme that 1) communicates the importance of plant diversity and ecosystem services in sustainable livelihoods and 2) promotes the need for action.
- Botanic gardens to develop their capacity for communication, education and public awareness through training or employing appropriately qualified education staff and/or collaboration with others that can provide this expertise".

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Biography

Helene Vilbert, B.A. Communication and Education, is a South African citizen residing in Argentina. She has worked in grassroots education in Brazil, Namibia, South Africa and Argentina.

Sourcing funding for arts activities via 'Percent for Art' schemes

Dr. Karen van Oostrum

Education Officer, Cambridge University Botanic Garden, United Kingdom

Introduction

The Arts Council of England endorsed 'Percent for Art' in 1988, as a means to integrate the work of artists into the planned developments of public space. Since then numerous council authorities across the country have adopted their own Percent for Art schemes. These schemes encourage developers to allocate a proportion (usually 1%) of the budget in any large capital project for spending on public art. It is an internationally used funding mechanism, often employed for commissioning contemporary artworks. Each council that adopts a Percent for Art scheme sets its own conditions of eligibility, which must be met for the money to be allocated. Cambridge City Council (CCC) adopted their Percent for Art scheme in July 2002, and it currently has the status of Supplementary Planning Guidance.

The Cambridge City Council Percent for Art scheme

If a capital development project meets given criteria set by CCC, the developer is obliged to pay the Art Levy (1% of its total budget). These criteria are:

- Residential developments comprising 10 or more dwellings, or a site area of 0.5 ha or more;
- Other developments where the floor space to be built is 1000m^2 gross or more, or where the site area is 0.5ha or more, including office, manufacturing, warehousing and retail developments;
- On smaller developments encouragement is given where the developers seek to include public art as a means of enhancing the quality of their development.

Developers can choose either to provide the art on-site (this is reported to be the preferred option) or they may contribute their Art Levy to a central pot. Those that wish to provide the art on-site often discuss their proposal with the planning officer before submitting it to the Public Art Steering Group for consideration. The Public Art Steering Group reviews all proposals (on- and off-site), makes recommendations on where to spend the money in the central pot, and receives and prioritises applications for funding, allocating money as and when it is available. Money in this central pot is limited (as most art is provided on-site), but any organisation may apply to use this money to fund art schemes around the city.

Art levy funding for Cambridge University Botanic Garden

The Plant Growth Facility

In 2004 the Department of Plant Sciences at the University of Cambridge built a Plant Growth Facility (PGF) in the private area of Cambridge University Botanic Garden (CUBG). The Art Levy associated with this new build came to almost £16 000. Staff from CUBG, Estate Management Building Services, and the Department of Plant Sciences met to discuss the possibility of using this Art Levy in an innovative way, for the benefit of the public.

The Community Arts Programme

A proposal was written for using this money to fund a 2-year Community Arts Programme. The description of each event within the proposal included the category and estimated number of the target audience, proposed methods for recruiting the target groups, potential collaborative organisations, publicity strategies, and fully itemised budgets. Aims were written for each event, as well as outcomes for the whole 2-year programme in terms of Public Art provision. The proposal also included a summary of current education provision at CUBG, and an explanation of how the proposed programme of arts-based activities would be new and therefore additional to current provision at the Garden (see appendix). The City Council accepted the proposal and the Garden delivered its first Art Levy funded activity in April 2005.

Art Levy funding has enabled the CUBG Education Team to develop its outreach activities considerably. We are working with groups that we were never able to reach before, and the activities, workshops and festivals deliver a vast array of creative opportunities to all participants. Local artists are employed to lead the majority of the activities. The funding ends in December 2006 and we are currently exploring new sources of funding to enable us to continue delivering arts-based activities to the public. In the future we aim to further the links already formed with community groups, and to develop links with new groups through an ongoing arts programme.

Activity	*Target audience*	*Collaborators*
Easter workshops	Children from local area	CCC Children's Team
Garden on a plate	Families	Local artist
Young mothers special project	Local young mums (16 - 24 yr olds)	Local 'Young Parent Project'
Willow workshop	Reccy Rangers	CCC Children's Team
Musical Plants Festival	General public, Families, Schools	Knock on Wood
Plant Fibres Festival	General public, Families	Local artists and story teller, Guild of Spinners, Weavers & Dyers, Hemcore
August Extra	Families	Local artists
Storytelling day	General public, Families	Gordon MacLellan
Getting ready for Christmas	Families	Local artist
Papermaking workshops	Families	Local artist
A view of the Garden	General public, Families	
Horticulture workshops	Young unemployed	CCC Employment Foundation Scheme
Art Trail & Easter challenge	General public, Families	Local artist
Art workshop with refugees	Refugees (unaccompanied minors)	Cambridge Refugee Support Group
Horticulture Workshop	Visually impaired adults	Thrive and Camsight
Garlands in the Garden	General public, Families	Local florist
Plants, Potions & Perfumes Festival	General public, Families	Fairyland trust, Downderry nursery
Cyanotype Photogram Workshops	General public, Families	Artist

Table 1: List of all events in the 2005 / 06 Community Arts Programme, the target audiences and collaborating organisations

Young mothers special project, May 2005

Horticulture workshop with young unemployed, March 2006

Art workshop with refugees, June 2006

Horticulture workshop with visually impaired adults, June 2006

Conclusions

The CUBG Community Arts Programme represents an unusual and inventive use of Percent for Art money, while satisfying the criteria set by Cambridge City Council. The Council stated: "Your proposal was the first of its kind used in response to the Percent for Art requirements and was considered to be a successful proposal." We believe that Percent for Art Schemes represent significant funding potential for public art events at Botanic Gardens and museums, and that it is worthwhile investigating the criteria associated with your local Councils' Percent for Art Schemes. This is especially significant if a new building is planned on or near your site. We recommend that you consider putting forward a proposal for using the associated Arts Levy to fund a community arts programme.

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Ms Rebecca Flood - Senior Planning Officer, CCC

Ms Christine Preston - Education Officer, CUBG, until 2005

Mr Colin Denston - Dept of Plant Sciences, Cambridge Univ.

Mr Kevin Bradbury - PGF project manager, EMBS, Cambridge Univ.

Prof John Parker - Director, CUBG

Appendix

Extracts from proposal notes summarising education provision at CUBG (current at October 2005) and an explanation of how the proposed Community Arts Programme would be new and additional to existing provision at the Garden

Current education provision at CUBG

The Botanic Garden holds the research and teaching collection of living plants for the University of Cambridge, a herbarium collection, and the Cory Library of horticultural and taxonomic works. Its fundamental purpose is to make these collections accessible for the current generation and to maintain them for future generations.

CUBG welcomes around 120,000 informal visitors annually. Provision of educational programmes for schools, colleges and for the general public through life-long learning and cultural recreation are also core activities. Two full-time and one part-time member of staff are employed to devise and deliver these programmes.

(i) Schools' education programme

Approximately 5,000 students in formal education, at all levels, visit CUBG each year. Topics studied relate directly to the National Curriculum and in most cases teachers contribute towards delivery of the programme, in partnership with the Education Officer (Schools & Community). Access to the Garden is provided free of charge for formal study, as is support and input from the Education Officer.

(ii) Adult education programme

A programme of short courses for adults is offered on a not-for-profit basis. Course topics relate directly to the collections held by CUBG, and can be categorised as follows:

- plant science and horticulture
- botanical illustration
- basket-making
- other plant-related arts and crafts

Course delivery is by free-lance specialist tutors or, in the case of horticultural courses, by CUBG staff. More than 500 participants attend courses each year, in order to access leisure learning or continuing professional development.

(iii) Events and other informal provision for public and community-based audiences

CUBG contributes to the Cambridge Science Festival each year by offering a Science on Saturday event, targeting family audiences. These free events typically attract an audience in

excess of 1,000 people. External funding is normally sought to cover the material costs of Science Festival events.

Subject to availability of funding, the Education Section organises other informal events and projects, from time to time. It has developed a track record for working in partnership to provide successful arts-based activities, drawing on the environment and resources of the Garden. These include initiatives for specially targeted audiences, such as the Wind Sculptures project in 2004 (a collaboration between CUBG and Cambridge City Council's Children's Team) and open access family events, such as Family Learning Week and The Big Draw.

To build on this success and reach a wider audience, CUBG Education Section must secure funding to underpin the development of a balanced programme of high quality, arts-based activities that can be offered, throughout the year.

2 Proposed Programme of 'new' arts-based activities

Activities in the programme will be 'new' in that they are additional to current education provision at CUBG. Drop-in elements, such as Easter and August Extra or the Plant Fibres Festival will enable the public to interact with art-based activities and demonstrations, as "added value" during an informal visit. Other elements, targeting specific audiences, will be accessed either via pre-booking or run as discreet events with no public access. No charge will be made to access the programme, unless in some cases, a deposit system is used to help ensure take-up of bookings.

The Botanic Garden will contribute staff resource 'in kind' by co-ordinating and administrating the new programme. The additional workload will be achievable as a result of the introduction of a new post during 2004, increasing Education Officer resource from 5 to 8 days per week. The work of the section is supported by a full-time administrator. Apart from the substantial contribution of CUBG staff resource, implementation of the proposed arts programme will depend on allocation of the forthcoming Arts Levy monies (<£16,000) for this purpose. If necessary, secondary sources of funding will be sought, in order to maintain high standards.

A garden for visually impaired visitors: A unique experience

Diane Turcotte

Montréal Botanical Garden, Montréal, Canada

The Courtyard of the Senses, created in 1999, is a small 500 m^2 garden at the Montréal Botanical Garden that introduces visitors to a whole new way of "seeing" the plant world. The Courtyard was nine years in the making, and was created with the help of Lions Clubs International, which raised the necessary funds. It was designed by the city of Montréal Parks Department, with guidance from two Montréal associations for the blind: the Institut Nazareth et Louis-Braille and the Regroupement des aveugles et amblyopes du Montréal métropolitain.

What sets the Courtyard of the Senses apart is the fact that the plants there are not intended primarily to be pleasing to the eye, but rather to take visually impaired visitors (and anyone else interested in a different kind of garden experience) on a tour that appeals instead to their senses of smell, taste, touch and hearing. Along the way they are guided by panels in Latin, English, French and Braille.

The Courtyard of the Senses is divided into four sections, with plants corresponding to different tactile sensations: soft, rough, prickly and sticky. The plants are carefully selected by a team of horticulturists, agronomists and guides, all working in close collaboration. Along with different textures there are the scents given off by the flowers and foliage of the wide variety of species and cultivars in this garden. The scents are the most difficult to settle on, since people perceive smells so differently. Before introducing a plant into one of the sections, the horticulturist consults the team of guides, who have developed extensive expertise over time. Even though we give each plant considerable thought, visitors' comments sometimes lead us to think that a given plant might have been better suited to another section.

In the **soft section,** there are fine, silky and downy textures, finely toothed leaves and other very hairy ones with a velvety surface. The scents in this section are pleasant, sweet, fruity and floral. Here we find honeysuckle, star magnolia and fruit sage, and such touchable plants as Schmidt wormwood, lamb's-ears and 'Silver Lining' mullein. In the **rough section**, leaf surfaces have a coarser texture, and the scents are lemony. Here visitors find strawflower and rocky mountain juniper, whose foliage consists of tiny scaled leaves imparting a finely abrasive texture overall. Lemon geranium and lemon verbena are also part of the landscape, in keeping with the lemon theme. Plants in the **prickly section** are chosen so as to avoid injuries, but still allow visitors to appreciate their jagged texture. Visitors are guided in touching the plants, and asked to do so very carefully. They can handle purple coneflower, whose flowers have a slightly prickly texture. The spicy scents in this section include basil, selected for its wonderful fragrance reminiscent of cloves and allspice, while the foliage of oakleaf geranium gives off a strong smell of black pepper. In the last section, common gum cistus is covered in resinous secretions that stick to visitors' fingers, perovskia has a penetrating fragrance that takes you by surprise when you stroke its leaves, and the blue gum tree has a strong medicinal smell of camphor. These are just a few of the plants in this part of the **sticky section**. Overall, there are more than 125 species and cultivars in the collection. A list is available on the Garden Website, at www.ville.montreal.qc.ca/jardin/jardin_virtuel/cour_sens/cour_sens.htm.

There are guides stationed in the Courtyard of the Senses from mid-June to early September. The program is intended for visually impaired visitors, but is also sure to interest anyone looking for a very different approach to the plant world. The Montréal Botanical Garden's guides (some with full vision and others blind or with limited vision) encourage visitors to touch, feel and sometimes even taste the plants. Although this is not a natural approach for most visitors, they end up playing along and enjoying the experience.

Visitors to the Courtyard of the Senses are like all others who come to the Botanical Garden, except that those with disabilities naturally tend to spend longer in this garden. In 2005, upwards of 9,000 people took part in the visitor activities offered in the Courtyard of the Senses. A survey conducted in 2001 by the Quebec Statistics Institute estimated that nearly 10,900 children have a visual handicap, and approximately 107,500 adults. A person is considered to have a visual handicap in Quebec if his or her vision meets the standards set out in the Quebec *Health Insurance Act*. It defines a visual handicap as follows: A deficiency that, after correction by means of appropriate ophthalmic lenses, leaves only a visual acuity in each eye of less than 6/21 (20/70) or a reduced field of vision in each eye and that, in either case, renders the person incapable of reading, writing or moving about in an unfamiliar environment. Despite these impressive statistics, only ten groups of visually impaired people visited the Courtyard of the Senses last year.

Visually impaired visitors find the experience just as fascinating as anyone else, with the difference that they require more support. There is a handrail running around the Courtyard, guiding visitors in complete safety through the four sections. The plants, placed within easy reach next to the handrail, are identified in Latin, English, French and Braille. The ground surface is different in each section, so that visually impaired people can find their way about more easily. Watching visually impaired visitors shows us how we use our own senses, in fact. I watched a young girl exploring the Courtyard to see how she explored her environment – not only with her fingers, but with her entire body. When she came to a juniper, she simply put her arms around it to "see" how big it was!

Our techniques are different when we work with intellectually impaired visitors. We consult the accompanying adult to determine the appropriate approach. Sometimes the visitor is uncomfortable with strangers, in which case the accompanying adult talks to the visitor and interprets our guide's instructions and comments.

Children with no disabilities are just naturally inclined to touch the world around them. With them, we take a two-part approach to touring the Courtyard of the Senses. They begin by exploring it on their own, sometimes running around the Courtyard, and then we give them a challenge. Using different playing cards, they have to find certain plants. This forces them to look closely at the plants and to focus on plants with specific features. Lastly, we ask them to put their sense of hearing to the test and try some musical instruments made from plants: a balafon (calabash gourd and rosewood), a thumb piano (calabash gourd), a rain stick (cactus stem), etc.

In the end, this little garden guarantees a unique experience for visitors of all stripes, thanks in large part to the exceptional job done by our guides, who make the rich diversity of the plant world accessible to everyone. They work tirelessly to help visitors feel a range of textures and smell the most subtle scents and rich fragrances. For to fully appreciate your surroundings, you have to learn to close your eyes. As Antoine de Saint-Exupéry's Little Prince discovered, "what is essential is invisible to the eye."

What do primary children say about plants as exhibits?

Dr. Sue Dale Tunnicliffe

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Introduction

Plants are an important part of the scenery of children's' lives. Children notice these botanical organisms in their everyday lives. Children recognise plants and name them with an everyday name or a descriptive name if they have not the 'correct' vocabulary. Failing to recall the name or to invent a satisfactory descriptive name, children refer to an unfamiliar specimen as 'plant', although the term 'plant' is used to refer most often to the flowering plants in a manner similar to the usage of 'animal' to mean 'mammal' (Bell 1981). School is not a place identified as a source of their information and pupils admit to learning little from books or the media but a lot from their own everyday observations and talking with family members (Tunnicliffe and Reiss 2000).

Children have a mental model of items, which they express through their conversations and drawings and writing. This expressed model is what we teachers have to base our assessment of that student's knowledge and understanding. Thus, the comments of pupils are important but the spontaneous comments of primary children at plant exhibits were unknown. It is important for botanical garden educators to know what pupils are likely to notice and comment about when they visit plants as exhibits so that meaningful learning interactions can be planned based on the spontaneous interest revealed in the comments of what the children comment on.

Method

The study was undertaken in a botanic garden in the south of England. Four hundred and twelve conversations were recorded from children ranging from five years to eleven year. The children came from nine different schools ranging from a private school nearby to a state school in a deprived area of north London. Many of the schools were in large year groups but they were all split by the teacher-in-charge into smaller groups of usually 6 children to go round the exhibits with an adult, the exception of one school who with three adults kept the class together. Thus, whilst occasionally one group of children was recorded for a few conversations there were many children and a wide sample of comments was gathered. Some of the conversations were including an adult, teachers or chaperone, whilst some were adult-free. The age of the children was either 6 years (year 2) eight years (year 4) or eleven years (year 6).

A conversation was taken as the utterances which started as the children came to an exhibit and close when there conversations came to an end and there was a gap before anything further was said which was about another plant. Permission for me to accompany the schools had been given in to the Education officer before the visit.

Conversations were analysed according to a categorisation scheme technically referred to as a systemic network (Tunnicliffe 1995). Essentially, a systemic network is a means of grouping or categorising things, in this case conversations, to be a parsimonious representation of the data, while preserving the relationships between categories in such a way that comparisons can be

made between groups. The network can be regarded analogously as the sets of nested boxes into which the researcher puts each part of the conversation and sections.

The main categories of the network were similar to that used for the analysis of the conversations at animals. The major categories of the network were, 'management and social comments' orders such as 'Come here', or social ones such as 'Sam.....' 'Ostensive comments' such as 'Look!' ' Where is it?' 'There!' 'Affective attitudes'; 'interpretative comments'; 'exhibit access' or 'orientation comments' in which visitors searched for or located the plants. And 'exhibit focused were another super-ordinate category comments.

Exhibit focused comments divided into 2 subordinate categories. Namely, other exhibits comments'-those about other aspects of the exhibit, such as a pond or the label and photograph, and plant-focused comments. The plant-focused category was subcategorised into six subordinate groups:

1. Interpretative comments, which included knowledge source comments such as questions and references to a source of the information proffered (called knowledge source comments);
2. Affective comments, which included emotive responses such as 'Ah!' or 'Ugh';
3. Environmental comments referring to the natural habitat or endangered status or conservation issues of the species;
4. Comments about the plants' structure;
5. Comments about the plants' physiology (equivalent to animal behaviour);
6. Comments about the plants' names. These included the everyday names, e.g. pineapple; category names such as 'plant', carnivores plant, Alpine plant, cactus; common names, for example Living Stone Plants, Giant Amazon Ian Water Lilly and occasionally the botanical name for example *Lithops* species.

Each category of comment had a number allocated to it. The numbers of the coding system are written over the relevant words. Not all the word have been categorised here for ease of reading.

39 2/4 21 29 /32

Year 2 boy: 'Oh look at these enormous lilies.

'Oh' is an emotive response, categorised as 39 and in the super ordinate category of affective comments. 'Look' is both a management command (2) as well as an ostensive comment (4) which is part of the category of Exhibit access comments showing other visitors where to look at an exhibit. The size of the plant, its dimension, is 21, part of the super ordinate category anatomy whilst lilies is a naming comment in the super ordinate category names (28) but is an everyday name (32).

Results

Most students talked about the exhibit and all but 7% of the conversations mentioned the plants. Two thirds named the plant in some way. Over half of the groups talked about an anatomical feature of which dimensions was the largest category,

A year 2 boy 'Oh look at these enormous lilies- are those enormous Lilly pads?'

Adult 'Yes'.

The results for the frequency of occurrence of main categories of conversational topics at least once in an exchange are shown in Table 1.

Table 1 Main categories of conversation

Topic	number	percentage
Management/social comments	213	52
Exhibit access	200	49
Exhibit focused	388	94
Ostensive	127	31

Exhibit focused comments embrace comments about other aspects such as labels and those elicited by the plants themselves.

Table 2 Exhibit Focused topics

Exhibit focused Topic	Number n=412	Per cent
Other exhibit	164	40
Affective	116	28
Interpretative	275	67
Environment	33	8
Plant focused	358	87
Anatomical	232	56
Functions	80	19
Naming	277	67

The anatomical features about which the students commented were leaves, 12%, flowers and fruits 13%, stems 3%, form of growth 23%, dimensions 23% and other 22%.

Function comments about the physiology of the plants were 19% with 3% about growth, 6% about food/photosynthesis and 'other 'were 11%. Naming comments were heard in two thirds of the conversations. Everyday comments were heard in 44% of conversations with 10% for common or scientific names. Categorisation of names accounted for 10% and only 2% of conversations mistakenly identified a plant. This was followed by 'Other' at 22% which covered topic such as spines, hairs. Only 19% of conversations were about functions and e were mostly comments about growing or making food, often associated with discussion at the carnivorous plants.

A Year 2 boy said, 'They eat flies, it’s meat'.

There were relatively few affective comments (which includes emotive ones of 'Ugh' and 'Ah' Such comments were generally ones of pleasure at 'pretty' flowers or disgust at a smell.

Only 8% of conversations referred to the plant's environment of the plant and its endangered status indicating that discussion of the rarity and conservation is infrequent. Plants as exhibits are far more easily seen so only half of conversations had an 'exhibit access' type of comments (e.g. Where?) and were often related to pointing something out to a peer or looking for something in particular. 'Other exhibit comments were heard at least once in 40% of conversations and the largest category was that of setting (22%) when the groups referred to an aspects of this such as the heat in the tropical house, the humidity elsewhere.

Touching plants was mentioned in 8% of conversations and the action occurred quite often. Labels were referred to by direct mention in only 5% of conversations.

What are the implications for botanical gardens and their educators?

These are several.

First of all pupils recognise and discuss salient features of plants at a relatively basic level. Eye-catching anatomical parts such as large leaves, enormous flowers or familiar items such as bananas or pineapples but in an unfamiliar context catch the attention of these visitors. The study has given an indication of what the groups spontaneously talk about even when they have a simple task. Some tasks set by teachers such as, 'Look for drip points', did provide a focus for the observations of the student so that they observed rather than looked at leaves to find this characteristic. Secondly, the study reveals that conservation of plants is not a topic spontaneously high on the agendas of these primary school groups. Thirdly organisers of visits to botanical gardens should a plan in an orientation time in the gardens when the pupils first arrive at a new site. Take them through the gallery or greenhouse twice, once for the 'look' and secondly for focused observations. All too frequently tutors, and the teachers who a brought the groups, who are familiar with the location, begin their teaching at once whilst the pupils are taking in the new sights and sounds.

Fourthly, be alert to the social dynamics of groups. Have the pupils chosen their own groups or have the visiting staff allocated them? Find out what is the situation and then build in time in your teaching for the interpersonal interactions between the group members to occur. Be alert to the stages in a field visit and plan the work accordingly with a concentrated focus near the beginning. Be alert too to the time when concentration has lapsed and other issues, such as lunch, become uppermost in the minds of the pupils.

Fifthly, plan opportunities for the discussion of moral, social, spiritual or aesthetic and cultural issues whenever possible and discuss attitudes towards the environment or pertinent local issues. Encourage too discussion about the use plants by animals including humans. Try to reinforce the idea that without plants there would be no animals as we know them. Encourage the pupils to interpret what they see from their own experiences before teaching them the science. By acknowledging and valuing their ideas and real experiences you involve students (and the adult accompanying them) in their learning. Acknowledge too that their interpretations may be of an everyday nature but value them as you discuss the accepted academic interpretation. Plan the co-operation of practical work so that tasks are shared and equipment looked after so that pupils realise this is an important part of field work.

Finally, talk about the feelings engendered during the visit and the role of plants in their own lives. What people feel about an occasion lasts a long time in their memories and can be the key to their remembering the facts.

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Biography

Dr. Sue Dale Tunnicliffe (BSc Zoology with botany subsiduray) PGCE and PhD (Science education) taught for many years at all levels, is a research associate at the Institute of Education London

Education in botanic gardens: Case study of the Limbe Botanic Garden multidisciplinary approaches to environmental education

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Abstract

The Mount Cameroon Region is one of the 25top biodiversity hotspots in the world. It is home to about 42 endemic plant species and has a population of over three hundred thousand people. The Limbe Botanic Garden acts as a window to this globally unique Mount Cameroon Region.

This Garden is a haven for both ex-situ and in-situ collections and runs a vibrant environmental education unit, which carries out educational programs that have demonstrated successes in connecting and engaging different people to plants. What are the objectives of multidisciplinary Environmental Education approaches? To…

- Provide information on the conservation of biodiversity to all visitors including children to the LBG, and to local communities in the MCR
- Promote the overall activities and functions of a Botanic Garden
- Create awareness on the cultural and economic importance of plants in terms of medicinal, food and flower values.
- Promote Participatory Biodiversity Conservation for all target groups.

This paper aims at:

- Highlighting the different EE programs that have demonstrated successes in connecting people and plants
- Presenting the different ways by which these programs are implemented
- Providing recommendations for the enhancement of these programs
- Justifying the essential role of EE in Botanic Gardens.

This paper underscores the methodology and difficulties met with the implementation of the purpose-driven multidisciplinary EE programmes (nature interpretation, holiday environmental education workshops, open fun days, outreach, etc). LBG receives a large number of visitors annually to its multi-disciplinary programmes and this paper looks guided visitor analysis from 2002 to 2005. The paper equally proposes some recommendations necessary for their improvement.

Key words: biodiversity, Mount Cameroon region, environmental building scheme, environmental education approaches, environmental responsibility, prospective natural capital

Introduction and overview

The Limbe Botanic Garden lies at the foot of Mount Cameroon. The Mount Cameroon Region (MCR) is one of the major centres of diversity in the world. Scientific investigation and elucidation indicates that there are as many as 42 strictly endemic species (Cable & Cheek 1998) in the MCR.

The Limbe Botanic Garden (LBG) provides services to assist the Cameroonian government in fulfilling its commitments to national and international protocols regarding botanic al gardens functioning. The activities of the LBG are highly prominent, as the institution currently is merging and expanding its programmes into a semi-autonomous institution 'the Mount Cameroon Biodiversity Conservation Centre' (Wirsiy, E. 2006).

The LBG draws both national and international audiences for admiration, observation and relaxation as well as scientific research. The LBG is a continuous pull for researchers who are exploring the potentials of the region in order to suggest innovative lessons for communities to preserve the natural environment of the region for future generations.

Given the fact that effective communication of a critical concept of protecting biodiversity is one of the educational challenges that botanic gardens face (Roots.Vols 1 (2), 2004), in 1999, the Mount Cameroon Project initiated a vibrant environmental education programme that planted the seed of awareness for plant and environmental awareness in and beyond the MCR.

Environmental Education (EE) at the LBG aims at maximizing connection between people and nature, while inspiring in visitors a sense of stewardship for the natural world that will enable the residents of Cameroon and beyond, maintain environmental quality.

A cadre of experienced and recognized biologists teaches the Garden's many visitors to be aware of the value and proper use of plant resources, to protect all life forms, and to play their part in to ensure sustainable economic and ecological development in the MCR.

Despite these efforts to engage different target groups with little initial interest in botanic gardens, some prominent drawbacks require improvement. Enhancement of existing techniques and the putting in place of novel multidisciplinary approaches will further deepen public involvement.

Existing multidisciplinary approaches to environmental education in LBG

At LBG, the Environmental Education program values practical and accessible approaches to expanding understanding of the people about plant diversity and the wise use of plant resources. Such multidisciplinary approaches include Nature Interpretation Scheme, Children's Environmental Education Workshop (CHEEW)**,** Outreach Environmental Education, Public Exhibitions, open fun day, etc.

Using the above EE disciplines, LBG ensures a participatory approach to the conservation of biodiversity for the improvement of local livelihoods and believes that scientific research, local capacity building, and public awareness would be continuous over time.

EE plays an important role in promoting change of attitudes by garden visitors. The question many people would ask is "do educative visit trips to botanic al gardens result in positive change of behaviour?" Revealing the wonders of the natural world opens the eyes of visitors to the

amazing values of plant resources and provides the need to nurture ecological environments for both present and the future generations.

Methodology

A. Planning

The overarching objective of the EE programmes is to build local capacities and raise public awareness about the general status of common plant resources. This impacts on livelihood support of local communities; habitat/species protection and biodiversity conservation; awareness in waste and waste management/pollution and hazard control; the role of botanic gardens as protected areas (including educational plots, habitat conservations, and plant collections); nature appreciation through interpretation and feedback mechanisms. EE objectives are tailored to the target audience's expectations and interests and are usually structured into practical and participatory projects that have local, national and global benefits. Concept note development is very important during planning. The follow-up and success of funding appeals determines the magnitude and feasibility of the educational approach. With necessary practicalities put in place, there is preliminary capacity building of facilitators by the experienced LBG staff (under the coordination of the education officer), who establish the objectives and expected outputs of any given programme.

B. Implementation

Careful preliminary planning of the execution phase then begins, taking into account available resources (both material and intellectual), the manner and stages of presentation, the specific interests of the target group, as well as the time frame for the programme. For a school group with an interest in plant identification, the education programme will include a brief introduction about the LBG, a description of the key plant families with prominent representatives in the Garden, as well as a complete plant identification tour.

Analysis and reporting of existing multidisciplinary EE approaches

A. EE fun day: Demonstrating commitment to environmental responsibility

In 1999, the MCP initiated the first Environmental Education Fun Day in an effort to communicate its participatory biodiversity conservation efforts to primary and secondary schools around the MCR. Since its inception, this biannual event has instilled a spirit of enthusiasm for biodiversity protection and has motivated positive behavioral change in over 15,000 young Cameroonians, who take part in creative, and hands-on games and prizewinning contests that allow children to have fun while simultaneously learning about the importance of protecting the surrounding environment.

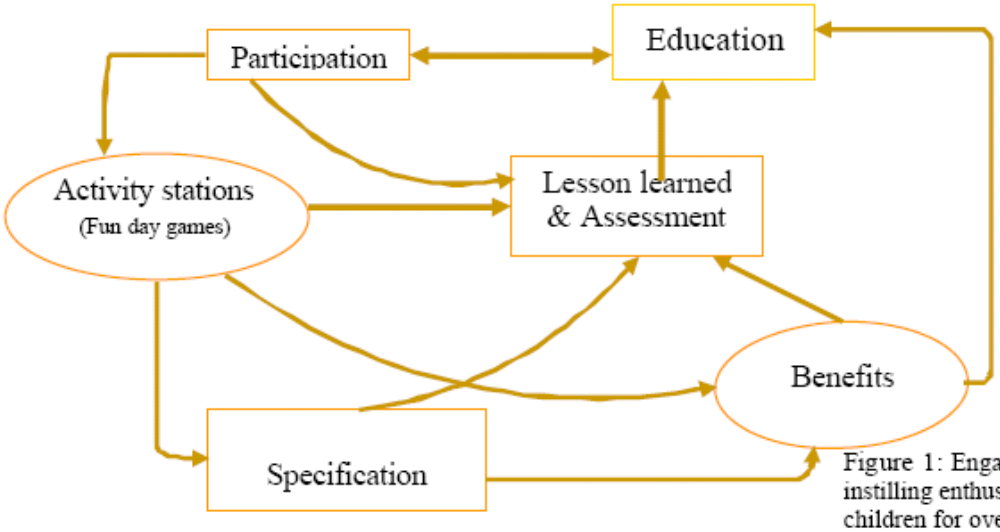

Figure 1: Engaging & instilling enthusiasm in children for overall educational benefits through interactivity in fun day games

B. Promoting participatory plant conservation awareness through the Nature Interpretation Scheme (NIS)

Historically, educational resources for the LBG have been scarce, and those that are available have not been directed at developing far-reaching programmatic efficiency. Education activities that meet the goal of broad environmental awareness and sensitization must become much proactive in order to supplement the scarcity of educational resources, including books, films, drawings, and interpretive material. Nature Interpretation in LBG is becoming one of the most important educational resources in the Limbe Botanical Gardens given that financial limitation is fast sidelining other EE approaches. The NIS started in February 2003 after a program of nature interpretation training was held. Of the 39 trainees, 8 were retained by the LBG. Since March 2004, only 3 of the 39 trainees remain in the Gardens as nature interpreters; though small in number, these professional interpreters bring a wealth of experience in nature guiding and have meticulous knowledge of interdisciplinary education work, community nature investment approaches, and public knowledge with environmental issues as evidenced by feedback collected from the numerous audiences.

Figure 2. *Interactive guided tour: a medium of sharing knowledge among younger group of students through field study trips at the Limbe Botanic Garden*

Table 1. Number of diverse visitors in the Limbe Botanic Garden from 2002 – 2005 by quarterly

Year	Quarter	NC	NCC	CMR	CC	Total
2002	Jan - March	299	66	148	570	1,083
	April - June	50	0	148	430	628
	July - Sept	45	3	242	124	414
	Oct - Dec	160	4	99	7	270
T-2002						**2,395**
2003	Jan - March	119	22	70	714	925
	April - June	146	8	375	454	983
	July - Sept	97	6	317	286	706
	Oct - Dec	139	3	164	411	717
T-2003						**3,331**
2004	Jan - March	159	3	249	507	918
	April - June	328	12	131	292	763
	July - Sept	81	39	126	1377	1623
	Oct - Dec	187	7	107	324	625
T-2004						**3,929**
2005	Jan - March	127	5	173	1083	1388
	April - June	171	40	167	188	568
	July - Sept	88	3	111	296	498
	Oct - Dec	169	0	143	101	413
T-2005						**2,860**

Target audience: NC, Non-Cameroonians; NCC, non-Cameroonian children (including pupils and students); CMR, Cameroonians; CC, Cameroonian children (including pupils and students)

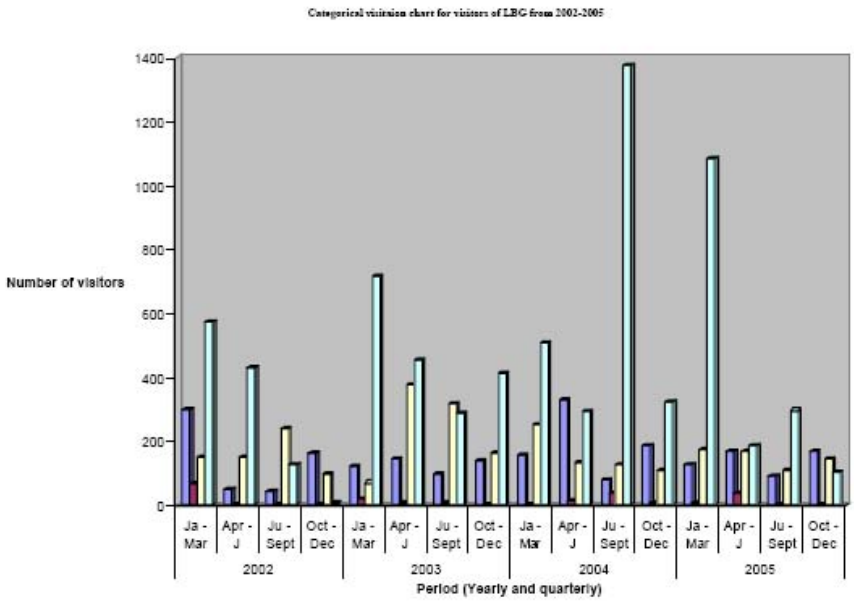

Figure 3a*: Graph showing trends in number and category of visitors at given time intervals from 2002-2005*

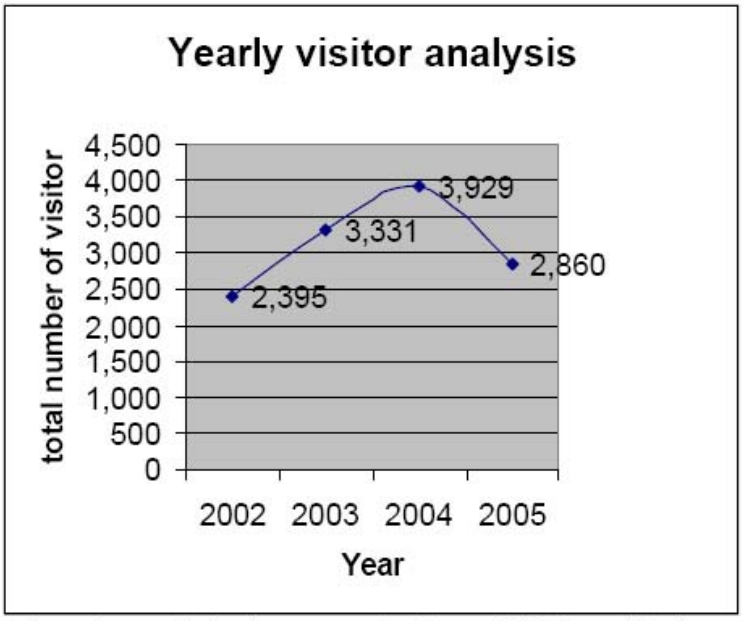

Figure 3b*: Graph showing progressive rise and fall of LBG visitation*
The LBG Garden generated much publicity during the lifetime of the Mount Cameroon Project, which ended in 2002. The Garden progressively received high numbers of national and international visitors. Since the end of this renowned project, however, the Gardens were faced with limited finances and less publicity, which has negatively influenced the annual number of visitors.

C. Enabling environmental responsibility through Children's Holiday Environmental Education Workshops (CHEEW)

Summer holidays provide unique opportunities for pupils and students as well as holiday makers in Limbe to explore more about the Limbe Botanic Garden and their surrounding environments. The EE department has developed an environment building scheme (EBS) incorporated into the CHEEW based on the guidelines set by LBG educational system. The CHEEW program is an interactive, informal and practical working session organized to build children's interest in plants

as well as in botanic gardens, and environmental protection. For over five years, about 500 children have participated in CHEEW.

D. Reproducing botanical operations in schools and empowering locals in ecological management

As part of our outreach initiative, we are currently working with 8 of the 20 schools in the Limbe Municipality. Because of our work, some of these schools are now running their own vibrant environmental, nature and garden clubs in their respective schools, which is a measurable success of part of our multidisciplinary EE approaches.

Another priority is to raise awareness among local communities who continue to depend on the ecosystems and natural resources for their livelihood. By working with bush meat hunters' associations, non-timber forest products harvesters, and firewood gatherers, we have been able to improve understanding and change behaviour of local people, as well as discourage them from environmentally degrading habits. Through this approach, we train and provide them sustainable resource management skills and stimulate their participation in alternative forest uses such as beekeeping, plant domestication (*Gnetum spp*), mushroom production, agroforestry as means of income-generation.

E. Using botanical garden activities to influence decision making

Displays and exhibitions on use of renewable resources within MCR, establish a means of sharing information with the public about support activities of LBG in sustainable plant/forest/ecosystem management. This is an excellent mouthpiece for communicating LBG's objectives and developmental goals to the public at large. Issues raised by the EE team through these displays and exhibitions, ranging from disputes over local land use and ecological threats to global climate change, help and incite decision/policy makers at all levels. By promoting public dialogue, LBG plays an important role in bridging the gap between the scientific and non-scientific understanding of the complex functioning of the natural environment. Educational exhibitions specifically transcend scientific barriers, spark meaningful discussions, and capture the curiosity of policy makers as well as many individuals.

Figure 4: Informing government dignitaries, decision makers and the public about wise use of plant resources through public exhibitions of a mini agric show in the Batoke local Community held in May 2006. The forest of Mount Cameroon is a haven for many useful non-timber forest products among which we have medicinal plants, local spices, ornamental plants, mush room, honey, etc upon which local populations depend for subsistence. Through exhibitions, the populations are kept aware of the threats imposed on natural resources as well as sustainable management approaches (domestication, harvesting, storage, marketing etc inclusive) that benefit them more economically.

Constraints

LBG, being one of the most biologically diverse and highly visited gardens in Central Africa recognizes a responsibility in environmental education as indicated by Agenda 21 of the Convention on Biological Diversity (CBD) with the application of wide ranging and purpose-driven multidisciplinary approaches. However implementation of these approaches has recorded some successes. Nonetheless, considerable impediments have been registered in the full and continuous follow-up of these approaches. Some of these difficulties are borne by inadequate finances to run sensitization, few or no EE policies integrated into school curriculum, little or no exchange programmes between botanic gardens, limited number of EE experts, interference of unqualified NGO in the EE sector and little participation of the local population in EE activities.

Recommendations

- Environmental Education in botanic gardens can succeed when all decision makers recognize that education offers viable alternatives for ecological independence, and that such educational programs require substantial financial input and serious planning.
- Apart from providing job satisfaction and advancement to professional nature guides, the nature interpretation scheme requires rigorous review and development to meet international standards that would maximize public enthusiasm for not only LBG but also a local environment engagement.

Conclusion

The multi-disciplinary approach to EE has impacted positively on plant and environmental awareness, biodiversity conservation efforts in the Mount Cameroon National Park and throughout the MCR. Despite reasonable successes, however, much remains to be done to permanently transform harmful environmental practices and attitudes of local resources users into positive and holistic thinking or interaction with all forms of biological diversity upon which we all depend. To some, the idea of Botanic Gardens is a myth, as visitors do not fully understand why botanic gardens are established or what role they play in their daily activities. The strongest argument for investing in botanical gardens is to disseminate information to a wide-ranging audience that will influence local thinking about ethical and responsible interactions with their inherited environment. The successful educational approaches would therefore seek to engage and connect people, kindle enthusiasm of the public, improve the quality of life, and build the capacity of local resources users and decision makers to invest in the surrounding nature that provides a "prospective natural capital" to all.

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Biography

I am Mr. Tanda Godwin Ade, a Cameroonian, holder of a BSc in Botany (Dschang, Cameroon); born on 29 April 1976 at Bafut and the Environmental Education Officer for LBG.

Plants and sustainability: *Welcome classes* at the Conservatory and Botanic Gardens of Geneva (CJBG)

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Background

Since the early 1970s, Swiss authorities have developed their environmental education policy in parallel with the development of the global environmental agenda. As our understanding evolved, it appeared that environmental education (EE) was no longer a luxury, but a necessity. When confronting with the present challenges facing our societies, environmental education has become a central pillar in our effort to achieve Sustainable Development (CDIP 2002).

Formal and non-formal education both play their part. A report by the Swiss Environmental Education Foundation on « The integration of environmental and sustainability education within school teachers training in Switzerland » emphasized the importance of environmental awareness in formal curricula (SUB/FEE 2004). Many environmental actors including environmental associations, scientific societies and botanic gardens are also providing education and training. A resource guide to these efforts was published (OFEFP 2005). Among these environmental educators is the Conservatory and Botanic Gardens of Geneva (CJBG). Some experiences of the CJBG are explained hereafter.

Welcome classes at the Conservatory and Botanical Gardens (CJBG)

At the CJBG, one of the ways we incorporate information about the importance of plant diversity into education and public-awareness programmes (GSPC, target 14) is by offering training to teachers and by collaborating with school projects. One key area of collaboration is with teachers who lead *welcome classes* (for the children of migrants to Geneva), with the goal of building their understanding of their natural environment through contact with the CJBG's plant collections while helping them learn languages and integrate into Swiss society.

What are welcome classes*?*

Geneva is an international and multicultural city. As new people come to Geneva, achieving Agenda 21 requires raising awareness about the natural and cultural environment. A specific structure to achieve this is provided by the Direction of Education: the *welcome classes*. These are small classes offered to migrants' children who do not yet understand French and are living in the canton of Geneva. They enable these children to learn the language rapidly, so that they can be quickly integrated into the regular school system.

A key to the success of this program is the flexibility used in regards to these children. A major part of the course is dedicated to learning the French language, using a method that promotes rapid learning. Importance is given to oral fluency and then to reading and writing. Courses in the different mother languages are also given, to consolidate basic knowledge and give the students a feeling of identity. Finally, the course also emphasizes an understanding of maths, German and

information on the local environment (Read more about this at: http://www.cagi.ch/en/Classes_accueil_Geneve.htm). With a group of *welcome class* teachers, we have developed a number of collaborative projects such as those described below.

Arts and science project

A first project was developed by teachers representing the disciplines of Arts and Science. Gabriella van Tuinen and Igor Denegri developed a *welcome course* to help raise the consciousness of children about local environment, flora and fauna, while building on their memories of the natural world in their regions of origin. To achieve this goal, part of the teaching would be done at the CJBG.

On a class visit to the CJBG, children explored the gardens and identified plants from their region of origin, whether in the greenhouses, the Rock Garden, the Arboretum or elsewhere. They were invited to choose one and draw all or part of it. Their attention was drawn to the information provided by botanical labels, which they were invited to note along with their drawings.

A second visit was organized, with the objective of deepening children's experience of artistic and scientific aspects of botanical illustration. The class studied books made available by the Conservatory's library, allowing students to learn how botanic illustration evolved through history. They then practised and copied the illustration of a typical plant from their region from the books. They were invited to note down anything they knew about the plant in their own language also, for example its uses, traditions or cultivation. Their works are now posted at the following Internet links: http://wwwedu.ge.ch/co/pixel/eleves/bio_av/ and http://wwwedu.ge.ch/co/pixel/eleves/bio_av/golette/GVT-IDN-plantorigine.html .

From their works, one can see how this approach allowed pupils to weave links between their past and new local environment, both natural and cultural.

The Winter Garden project

Another group of teachers worked on economically useful tropical plants assembled in the Winter Garden. This collection is presented by themes: fruits, spices, fibres, chewing material and beverages. It also sets out objects and household products in windows, botanical labels and interpretative signs, all of which invite visitors to recall the links between plants and their everyday life.

The Winter Garden project includes several learning units. One of these helps students to experience climatic differences between outside and inside and why some plants require a greenhouse; to discover a number of economically useful plants and how we use them everyday; to collect information about them; observe and describe shape, structure and color diversity in plants ; to learn about the history and geography linked to agricultural products. For each of these units we developed some teaching material and a sequence.

Another unit invites pupils to fill out a form with some information about the spices or aromatic plants their parents or relatives use, how these are linked to their traditions, and what properties the plants offer. For this purpose, the students would interview their families. They then are asked to locate these plants within the Winter Garden, and to draw them and note down scientific information. They later research and compile information, which involves using several computing programmes such as Excel, Word and Internet. This information is ultimately

compiled in individual posters about these plants, which are designed and presented by the students.

Another unit is currently being prepared, for pupils who are newly arrived to the *welcome classes*. These are based on direct experience and require no understanding of a particular language. This unit could be used as an introduction to the above activities, and involves guiding the class through the gardens using pictures taken in the gardens, the location of which pupils will have to indicate on an A4 printed map.

Together these learning units support the rapid integration of young children from migrant backgrounds into Genevan school system. Also, by helping them to acquire consciousness about the importance of biodiversity, and the role of plants in the diversity among human cultures, they will strengthen the recognition and confidence of their own identities, while helping them to find a meaningful place in their new surroundings.

Teachers training at the CJBG

As well as collaborating with *welcom classes* teachers, CJBG offers training to primary and secondary school teachers. Through participation in activities at the CJBG's facilities, teachers can gain new insights into how to communicate the importance of plants and the natural world to their students.

For primary school teachers, the educational value of the Winter Garden favoured specific training units that are linked to this collection. Some sixty primary school teachers have participated in these activities to this date. To teachers of younger children, we suggest simple hands-on activities, involving sensory experiencing. This led to the development of a school project on "History and Geography of Spices", which provides learning opportunities for all disciplines.

For secondary school teachers, the Winter Garden provides a perfect exploration field to work on disciplines of citizen education in the framework of projects like « Clean Clothes Campaign », Fair trade (bananas, cotton, coffee, for example) and other themes addressed by the Swiss formal curricula.

During those one-day training seminars at the CJBG, we share experiences on how to use botany and plants in general – and more specifically the Garden's live collections – within teaching activities. At the end of the day, teachers are able to prepare school visits, or lead activities based on one of the garden collections.

Conclusion

Working for and with the *welcome classes* and their teachers has been inspiring for us at the CJBG. Through these classes, students learn about the environmental and economical aspects of plants, contributing to their social integration while recognizing the value of their own culture and history. It is very satisfactory to see young migrants studying plants, experiencing moments of peace and concentration, and sharing cultural heritage.

In our experience, teachers have been quite surprised on how engaged and interested the pupils are during the activities. Young teenagers worked with great interest and acquired not only some knowledge but also confidence and recognition of their own identity. They also discovered the

Botanic Gardens as part of their new life environment. As a result, the teachers of *welcome classes* are ever more motivated to continue teaching within our plant collections.

We hope to continue contributing to the formation and integration of many young people coming to live in Geneva. Some will probably become the grand-parents of tomorrow, bringing their grand-children for a walk along the flowered floors and towards the playground, admiring the tropical plants of the greenhouses!

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Abbreviations

CJBG	Conservatory and Botanical Gardens of Geneva
EE	Environmental education
FEE/SUB	Fondation Suisse d'Education pour l'Environnement
GSPC	Global Strategy for Plant Conservation

OFEFP Office Fédéral de l'Environnement, des Forêts et du Paysage

Web sites

http://www.umwelt-schweiz.ch/buwal/fr/fachgebiete/fg_umweltbildung/acteurs/index.html

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Biography

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USING TECHNOLOGY TO SUPPORT SUSTAINED STUDENT INQUIRY IN LEARNING ENVIRONMENTS BEYOND THE CLASSROOM

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Abstract

Botanic gardens educators have cited the challenges they face in creating learning situations that support ecologically sustainable development (ESD) for teachers and their students. Such programmes require the facility to engage students in longer-term and more meaningful interactions with a botanic garden. These programmes also need to arise from school curriculum documents and the unit planning processes that form the professional work of classroom teachers. This paper reports on the work of an Australian Federal Government funded project that aims to engage students in sustained inquiry of their local environment. Student inquiry is supported by the use of mobile technologies including tablet computers. Classroom teachers develop units of class work based on student investigation of aspects of the local environment. The project is supported by scientists and naturalists from universities, museums, local council and local naturalist clubs and societies. Students have the opportunity to interact with this scientific community directly and via the internet. This community of learners produces a database of local plants and animals that is made available to the public as an engaging record of local biodiversity.

Introduction

Researchers have spent the best part of the last four decades exploring the nature of the visitor experience in museums, national parks, zoos, science centres and the like around the world. Many studies have described the memorable nature of these experiences and their dynamic potential to support learning (see for example Rennie & Johnston 2004, Rickinson et al 2004). The work of botanic garden education programmes in supporting ESD as reported by BGCI (Willison 2006) can be viewed as examples of high quality learning that is life-changing for its participants. The picture that is emerging from these studies and activities is that classrooms are not the only places were learning happens. Indeed some of the most memorable parts of our formal education can often involve learning experiences that take us beyond the classroom.

For educators and researchers working in the context of schools and other centres of formal learning, a major focus is to support strategies that embed students' learning experiences beyond the classroom into school-based teaching and learning practice. Such inquiry involves conceptualization of teaching practice (pedagogy) that routinely utilises students' learning experiences beyond the classroom and that can sustain the impact of these experiences by incorporating them into meaningful learning back in the classroom. In exploring the concept of what is meant by meaningful learning, this paper utilizes the notion of high quality learning and teaching drawn from the work of Newmann and his associates (1996) and the American 'authentic pedagogy' movement.

Disciplined study reveals the nature of the learning experience school students have when the site for learning changes from their classroom to another venue. This paper draws on the author's personal research of the learning experience of school students on excursions to botanic gardens on Australia's east coast. This research coupled with more than 15 years of experience as a botanic garden educator has lead to conceptualization of this learning experience as a *mobile* learning experience and students working in learning environments beyond the classroom as *mobile* learners.

Botanic garden educators understand that people learn when they are on the move. Active involvement of the visitor, sensory experiences, moving from place to place within richly diverse spaces are features of most experiences in a botanic garden. One of the features about learning in a botanic garden commonly identified by school students is that they are outside and they are moving around (Stewart 2003). Indeed the mobility of the learning experience appears to be common to most learning environments beyond the classroom. The concept of designing curriculum and pedagogy that can scaffold or support high quality mobile learning is the central focus of the author's current research, part of which is reported in this paper.

This paper will consider the characteristics of a high quality mobile learning experience. The paper will also report on the work in progress of an Australian project funded to support school-based curriculum development that utilizes technology to enhance students' mobile learning experiences.

Characteristics of high quality mobile learning

Professional educators are concerned with being able to articulate what it takes to produce highly motivated learners and meaningful learning and for the past decade researchers have endeavoured to define and describe what is meant by high quality teaching and learning. The 'authentic pedagogy' movement in the USA (Newmann & Associates 1996) presented learning of a high intellectual quality as occurring in situations where students are actively involved in constructing knowledge rather than replicating someone else's expression of knowledge. Furthermore, Authentic pedagogy occurs when learning involves deeper understanding of fewer topics that are perceived as highly valuable by students and their communities. This significant research has lead to the concept of 'authentic pedagogy' being modified and adapted in education systems across Australia e.g. 'Productive Pedagogy' in Queensland and 'Quality Teaching Framework' in New South Wales (NSW).

In NSW high quality learning is viewed in a framework consisting of eighteen elements. Schools and teachers are being encouraged to adopt use of the elements as the basis of professional discourse to describe learning. It is beyond the scope of this paper to explore detailed analysis of this framework however a small number of elements have been selected for the contribution they make to articulation of the concept of quality mobile learning.

Some of these elements taken from the NSW Department of Education and Training's quality teaching framework (NSW DET 2003) include:

- sustained student engagement and self-direction;
- deep knowledge that is integrated across topics and /or subject areas;
- significant both to the student and to the wider community;
- opportunities for substantive communication and collaboration between peers, between students and teachers and other adults including professionals and community members.

The next part of this section moves from this discourse to that of classroom teachers who bring their students to a botanic garden and have been asked to describe a 'worthwhile'

excursion (Stewart 2003). For these teachers the fundamental feature of a worthwhile excursion is its relevance to the particular unit of work that the teacher is doing with their students in the classroom at school. It is clear that the unit of classwork provides the learning context for the experience students have beyond the classroom and the event occurs as part of the learning sequence detailed in the teacher's programme for the unit.

This learning sequence incorporates planning for the excursion when students are involved in articulating the need for and relevance of the excursion. On return from the excursion, teachers observe that their students have been enlivened by the event. Its rich experiences are incorporated into the classroom learning of the group and references are often made to the event.

It is clear to educators that worthwhile learning experiences are active. They involve and engage school students. Students are motivated to actively participate in practical and enjoyable experiences in this different location. Activities involve collaboration and communication with a range of peers, educators, venue staff and other adults associated with the excursion (Fig1).

Figure 1 A scientist from the Australian Museum works with students to identify insects they have collected

Practically speaking, teachers want their students to have a positive experience at the venue. They expect their students to be encouraged to interact with appropriate staff, objects and environments. Venue staff are seen to welcome the visiting group, there is ample provision made for the group, activities commence promptly and the day goes as planned.

This brief account highlights a number of essential practices associated with meaningful mobile learning specifically:

- its relevance to a unit of classwork;
- activities involve students in engaging, practical experiences;
- these experiences are both anticipated by students and re-worked in further learning activities on return to the classroom;
- there is substantial communication within and between the parties involved;
- there is a clear and high expectation that students will learn in and at the venue.

Supporting mobile learning

Clearly the central feature of support for high quality learning is the curriculum. This is the formal learning plan that creates a meaningful learning context within which the elements of quality teaching and learning are located. This learning plan is best created by the school-based classroom teacher supported by a range of resources that facilitate planning, delivery and evaluation of this innovative work.

It is this innovative work that is being supported by funding from both the Federal and State governments across Australia. A recent example is seen in the Australian School Innovation in Science, Technology and Mathematics (ASISTM) strategy. This paper now reports on a project that received ASISTM funding to form a collaborative group of schools, universities, museums, local councils and local community organizations to explore the use of technology to support mobile learning.

It is the intention of this project to recognize the centrality of school-based curriculum design by providing classroom teachers with access to a wide range of resources including personnel as well as computer and other technologies. Project teachers are also provided with time to plan, conduct and evaluate a unit of classwork that focuses on their local environment. The units of work developed by the project involve:

- student lead, collaborative inquiry;
- integration of bodies of knowledge including scientific and cultural;
- sustained learning in environments beyond the classroom;
- access to scientists both in person and by the internet;
- access to knowledge about the local environment held in the community;
- student use of mobile technology including tablet computers and digital cameras; and
- construction of a website and database containing information about the local environment.

Topics chosen by project schools include investigation of plants in the school grounds, insect diversity in a local park and the journey of a drop of rain after it falls on the school playground. The units of work developed around these topics all involve mobile learning and teachers and students themselves decide the IT support they require when their learning takes them beyond the classroom. Students are encouraged to work in collaborative groups to plan and conduct activities such as website and data-base design, field work, communicating with scientists and members of the local community.

The work of the project has generated the need for a range of technologies to support students and their learning (Fig 2). It is the intention of the project to respond to the need for technology required by the classroom activities of the project schools rather than impose technologies onto the project. IT expertise is provided by both the IT Faculty and the IT staff of the Faculty of Education & Social Work at the University of Sydney. As part of their course work, undergraduate IT students can elect to work on IT aspects of the project. To date software has been designed to support school-based web sites and to support student record-keeping in the field.

Figure 2 A range of technologies support mobile learning

The availability of tablet computers (provided by the Faculty of Education and Social Work at the University of Sydney) is seen to unlock students from their desks and offers a range of ICT capabilities to the project to support mobile learners. While working in the field, students

have explored the use of wireless capabilities to access remote experts who assist with the identification of found species. Once a species name is known, students can access further information by using wireless internet connection to conduct searches of the internet.

Digital cameras have proven to be an effective aid to capturing students' observations in the field. Students are using the technology to capture high quality images from the first instant they use the camera. Field equipment including binocular microscopes and binoculars also play a role in the project and students have found creative ways to incorporate its use into their digital record-keeping (Fig 3).

Fig 3 Alyson's pic of an ant through the binocular microscope

The need for seamless transfer of student work between classroom and the field has been met by the use of 'flash drives'. Students are encouraged to consider how they will keep a record of their experiences in the field. Often students compile their own template to record their findings. Using the flash drive, this template is transferred from the school computer to tablet computers for use in the field. Once completed these and photographs and other digital records created by students in the field can be saved from the tablet computer onto the flash drive and transported back to the classroom.

Currently the project is working to address an identified need for electronic tags for the trees in the grounds of a project school. The purpose of the tags is to provide an electronic link between individual trees and student generated data about the tree. Project students have expressed a clear demand for software that allows them to create more 'professional' and complete documents whilst they are working in the field. In addressing this need, the project is utilising the software designed by the undergrad students from the Faculty of IT.

The project is generating interest in a range of communities. Firstly the members of a local naturalist group have visited project schools and provided extra resources to assist students with their research of local biodiversity. Volunteers from the naturalist group have accompanied students on trips to local parks and natural areas and help students with their field investigations. The local media has responded to students' work by both attending and publicising school field days.

Schools are interested in the units of work generated by the project, the pedagogy that scaffolds the mobile learner and the practical use of ICT. Local environmental education centres will be able to utilize the units of work to demonstrate to visiting teachers examples of ways in which their excursion can be relevant to classwork. It is also envisaged that the database of local biodiversity created by the project will be incorporated into the resources of a number of environmental education centres.

Conclusion

This paper has explored the concept of quality mobile learning by linking the concept to the wider research of quality teaching and learning. Parallels were found where the mobile learning was made significant and relevant to students and their local communities by being embedded in a unit of classwork that addresses issues and topics relevant to the students and to the school and its community. The mobile learning experience itself is active and student centred. Indeed it is as if the classroom and its resources have been moved from the school to the venue for the day. Students continue with the learning sequence of their unit of work in a different working environment. New and different resources including objects both living and non-living as well as specialist people are encountered in this new environment and students feel confident to interact with this rich range of resources. The records students keep of the day return to class and are incorporated into the on-going sequence of activities.

Technology can be used to support the mobile learning experience. Computing facilities available in the students' classroom (or at school) are available in the field. Photographs, audio records of interviews, measurements and other field records can be digitally recorded and transported back to the classroom. These records are incorporated into the significant products that will be generated by the unit of classwork that currently involves the students.

The products achieved by the unit of classwork are made available to the wider school and community and represent a re-working and furthering of the knowledge held within the local community.

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Queen Sirikit Garden: Garden for the blind

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Introduction

Thailand is situated in the middle of Southeast East Asia with an area of 513,115 sq. km. and with a population of approximately 64 million. There are about 123,157 people with visual impairment (National Statistical Office, Thailand 2001), and it was reported that there are about 1,000 persons from 1,650,000 in Chiang Mai, Thailand, officially registered as blind.

Many institutions, under the Thailand Association of the Blind and Ministry of Education in Thailand, have tried to serve the blind various educational programmes in same level as general children. According to that, the blind schoolchildren in Thailand have a chance to study the same curriculum as ordinary students, but they still need to be supported for their biological knowledge outside the books especially from environment. From opinions of students and teachers in blind school, Chiang Mai, it was found that even though there are a lot of materials to show them what plants and animals look like, the real things and objects are the best choice for them to imagine.

To fulfill the lives of the visually impaired children by getting experience on nature and learning through exploration using the senses of hearing, touch, smell, and taste. The QSG has a plan to create the "Garden for the Blind" since 2005.

The Queen Sirikit Garden (QSG), Bangkok, was founded in 1993 with the aim to be a garden and forest in the city and education place to enhance the plant conservation for the city. During the past 10 years of development, QSG has well served the city community and general public, while very high attention was also given to school children. However, a project for the visually impaired has just been established. The garden has developed educational programmes for a wide range of audiences, including youth, schoolchildren, university students, community members and tourists. These aim to achieve the goal of botanical gardens to become models of sustainability through work and education programmes, promoting the means by which everyone can become involved in creating a more sustainable way of life.

These days, there are few places in Thailand that provide facilities for the blind, especially on botanical activities. To accomplish this, QSG is working on a safety area to educate them about the environment and plants, including their usefulness and importance to our lives and other living organisms. There will be represented by other attractive senses such as hearing, touch, smell and taste. We have formed a group of educators with diverse backgrounds to design the "Garden for the Blind" and develop the educational programmes with the blind and non-blind to share the same experience.

Objectives

1. To assist actively in knowledge about plants as an "outdoor classroom" for the blind and handicapped students.

2. To empower children of marginalised groups with knowledge relating to plants and environment, with the help of information technology.
3. To serve wider visitors besides the scientific community and nature lovers.
4. To share experiences between ordinary people and people who are visually impaired
5. To encourage people to realise and care about the importance of plants and environment.

Themes of garden and activities

To create a place with special atmosphere in the garden to entertain and educate the blind consisting of materials and tools of touch, smell, sound and taste, etc.

Description of this project

A corner of the garden has been designed to appeal to the visually impaired students and those with multiple physical challenges. It is a complement to classroom teaching and fits into the schools' curriculum. By feeling the different textures of various plants and experiencing the unique fragrance and taste of each, the blind will be able to identify them. The rail, footpath symbols, sound from audio-guiding system, tactile maps, pamphlets and educational materials in Braille will assist orientation and reduce danger of getting lost.

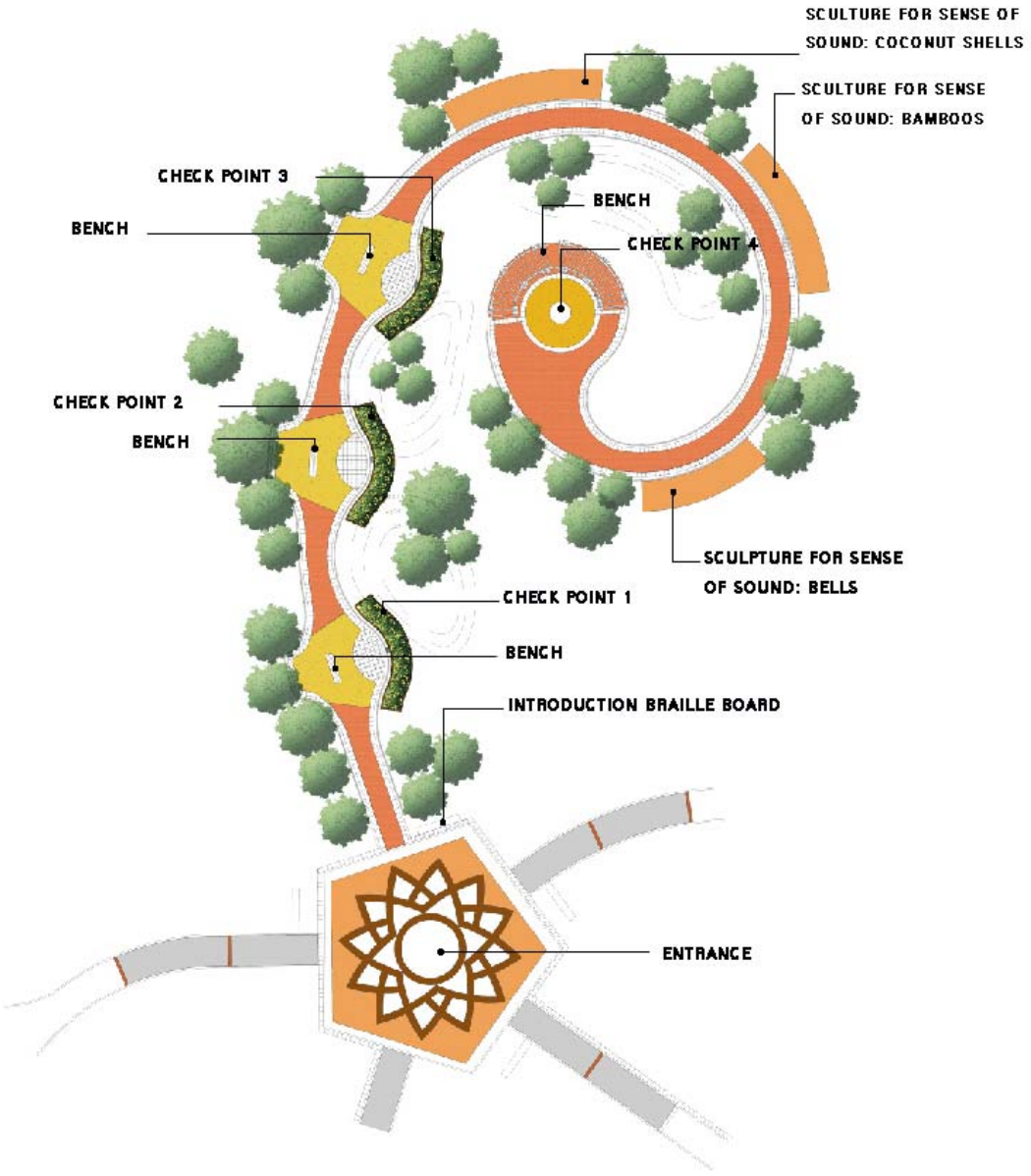
The labelling of plants and trees will be done in Braille or raised letters throughout the garden. It has been designed together with special facilities such as a toilet for handicapped and using strong colour contrast to help the blind locate toilet, basin, light switch, etc. "Garden for the Blind" allows the visitor to use all senses, and careful touching of the plants is encouraged. This project also provides a chance for general people to feel how the visually impaired persons use their special talent of senses by trying to be blind when they explore this garden. A design of the garden is in Figure 1 to provide an image of information presented below.

A Braille board at the entrance explains the topography and introduction of the garden including instructions for children to walk around without any help. To facilitate easier movement of the blind, the garden is accessible by footpaths lined with chequered tiles. Braille board and labelling a brief description of plants in the garden by telling them the botanical, English, and Thai local names and additional information about the plants which are mostly kept in the pots, baskets or special containers, which are easy to replace.

Introduction Braille Board:

Humans consume plants as food, material to build their houses, cloth, medicine, etc., the same as animals and insects. There are about 15,000 species of plants in Thailand. Their habits are mostly tree, shrub and herb. Some of them have adapted themselves to survive in the specific habitats such as the climber that is able to climb up to the top of the tree by their special stem and tendrils to get more sun light.

Figure 1: Design of the "QSG Garden for the Blind"



Check Point 1: Sense of Touch

It is shown by the shape and texture of petals, leaves, barks or fruits. The surface of them can be shiny, smooth, rough or hairy. The blind can identify the plants by comparing the sizes and textures.

President of Thailand Association of the Blind, Northern Thailand Branch, also advised to put some spiny plants with clear labels and signs to let the visual impaired persons try and realized about the danger of plants in real life. Even though we think it is dangerous, he said "they need to know the way adapt to the nature."

Check Point 2: Sense of Smell

The visually impaired visitors can explore the impressive scents of flowers and leaves of spice plants. There will be labelling explaining the uses of their chemical substances to be condiment, perfume, joss sticks, component of medicines, etc. which are useful in everyday life.

Scents from flowers: rose, jasmine, magnolia, etc.

Scents from leaves: basil, lemon grass, pandanus, etc.

Check Point 3: Sense of Sound

There will be musical instruments made from plant parts such as bamboo, coconut shell, and wood, etc. The blind will able to touch and play with them along with storytelling in braille.

Check Point 4: Sculpture

A large sculpture is made to provide a surprise touch for the blind. It is large, safe, has fancy colours and embedded with simple animals found in the garden such as snakes, frogs, birds, squirrels, rat, etc. A blind can touch the sculpture and feel what the shape of the animals look like and this will be accompanied by sound and Braille explanation.

Conclusion

The Garden for the Blind is designed with the theme of sharing the world of local wisdom and plants and environment. The garden components are developed from the interviews with visually impaired students and adults, Blind School teachers, psychologists, horticulturists, and ethnobotanists. It is hoped that "Garden for the Blind" not only provides a learning place for the visual impaired students, but also reminds those of us with sight how much we take for granted the glorious gift of plants and nature.

Acknowledgments

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Brooklyn Botanic Garden's children's gardening program: A survey of alumni

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Abstract

Among public gardens, Brooklyn Botanic Garden (BBG) hosts the oldest children's gardening program in the United States. Founded in 1914, the Brooklyn Botanic Garden Children's Gardening Program (BBG CGP) has succeeded in involving a steady flow of children year after year, creating an environment where children have the opportunity to interact with nature. Approximately 35,000 children have participated in the BBG CGP since its inception in 1914. A mail survey was conducted of alumni of the BBG CGP in the spring of 2005 to identify how the hands-on program has affected their adult lives. A random sample of 700 participants was selected from the BBG CGP alumni records of which there were names with current addresses. Ninety-eight alumni responded to the mail survey for a response rate of 25.6%. The survey consisted of 45 questions which were divided into five major sections: 1) Current gardening interest, 2) Involvement with public gardens, 3) Current involvement with children's gardening programs, 4) Childhood experiences in the BBG CGP, and 5) Demographic variables. Adult alumni reported they enjoyed their experiences as a child participant in BBG's CGP. Alumni also indicated the program helped in the development of various personal skills as well as increasing their self-esteem. Over 30% of alumni stated that the program helped them choose a career path, which in many cases was within the natural sciences field. Results suggest the participant's childhood development and 22 learning skills gained from this program have played an important role in their adult lives and they regard the BBG CGP as having great value in their lives.

* * *

Growing interest in connecting children to gardens prompted this survey study of Brooklyn Botanic Garden's Children's Gardening Program (BBG's CGP), the oldest public garden children's gardening program in the United States (Maclin and Hyland 1999). Since 1914 when BBG's CGP was founded, approximately 35,000 children have participated in the program with approximately 800 children participating on a yearly basis. The focus of this 3/4-acre childrens' garden is to develop horticultural skills among urban youth through hands-on activities and inquiry-based learning. This is done by letting program participants grow and tend vegetables and flowers in their own six foot by six foot garden plot. Different children participate year after year, cultivating their own garden plot each season. A spring session runs on Saturdays from the beginning of April to the end of June; two summer sessions run three days a week in July and August; and a fall session meets on Saturdays in September and October (Maclin and Hyland 1999).

The objectives of the study were to investigate the possible benefits adult alumni gain from participation in BBG's CGP and how the program has impacted their adult lives, if at all. A mail survey of BBG's CGP adult alumni, ages 18 to 101, was implemented during Spring 2005. A

random sample of 700 alumni was chosen from the BBG alumni database. A modified version of the Dillman method was followed for the order of survey mailings (Dillman 1978; Salant and Dillman 1994). Of the 700 surveys mailed out, 298 were returned as undeliverable. Out of the 402 eligible surveys, 98 surveys were returned between March 2005 and May 2005, for a response rate of 25.6%

The survey consisted of 45 questions and was divided into five major sections: current interest in gardening; current involvement with public gardens; association with children's gardening programs; childhood experiences in BBG's CGP; and socio-demographics. The survey questions were based on findings from a qualitative study titled, "Brooklyn Botanic Garden's Children's Gardening Program: Its meaning and impact on adult alumni" (Tims 2003)

The data were analyzed using the Statistical Package for the Social Sciences (SPSS, 2004). Descriptive statistics were performed on the response variables to summarize the experiences of alumni of BBG's CGP. Analysis of qualitative responses summarized the experiences of alumni (Hatch 2002).

The demographic data of survey respondents were 69% female and 31% male. The ethnic backgrounds of respondents were 79% Caucasian, 9% African American, 9% Native Americans, 2% Asian and 1% Hispanic. The majority of respondents (45%), were between the ages of 40 and 59 with 28% between ages 18 and 39, 20% between ages 60 and 79, and 7% between the ages of 80 and 101. It was determined that alumni from BBG's CGP are highly educated, with a majority of alumni (83%) having received college degrees or higher. Only 4% of alumni surveyed did not complete high school.

Results from this study suggest that BBG's CGP does have a lasting impact on its participants throughout their adult lives. Respondents of all ages were able to recall experiences from their CGP participation in detail, indicating that the program does have a lasting impression upon participants. Study results also indicate that children who participate in the CGP will most likely garden as adults. Eighty-five percent of respondents felt that their CGP participation played a significant role in their current interest in gardening. This emphasizes the value of children's gardening programs in building the future gardening population.

Study results suggest that those who participate in BBG's CGP have interest and participate in public gardens as an adult. Seventy-eight percent of study participants felt their involvement in BBG's CGP is the reason they visit and participate in public gardens as an adult. Of these respondents, 23% have a BBG membership, 12% volunteer at public gardens, 28% make financial donations, and 27% participate in public garden workshops. This supports justification for creating and offering public garden children's gardening programs and identifies long-term benefits of such programs to public gardens.

The majority of alumni respondents (86%) felt positive about their experiences as participants in BBG's CGP. The positive experiences and recollections of respondents were grouped into five themes: 1) Harvesting and bringing home produce (57%); 2) Learning in the children's garden (56%); 3) Friendships (25%); 4) Winning Awards (17%); and 5) BBG's City Green Space (16%). These themes indicate important elements of a children's gardening program to its participants and identifies the key aspects of a gardening program that administrators, managers, and teachers need to ensure are experienced by participants.

Hands-on activities and inquiry-based learning did teach lasting gardening concepts to participants of BBG's CGP. Study results suggest that participants who cultivate and grow their

own plants in a children's gardening program do learn key gardening concepts especially weeding, bed preparation, watering, and harvesting. When asked about the horticultural skills they learned in the program, 97% of alumni agreed they learned most about weeding. Alumni also indicated they learned a great deal about "preparing a planting bed" (92%), watering" (96%), and "harvesting" (95%). Alumni also recalled learning basic gardening skills such as planning a garden plot (88%), transplanting (85%), garden tools (83%), and mulching (75%). One alumnus responded, "People always ask me how I know so much about gardening! My foundation comes from BBG's CGP. Probably, my passion for gardening comes from that also." This data indicates what gardening concepts children participants learn and retain through hands-on, inquiry-based gardening programs.

Improved self-esteem was a lasting benefit to participants of BBG's CGP. The majority of study respondents (64%) felt they gained in their self-esteem through their CGP participation. Participants felt their self-esteem was bolstered through growing their own plants and having success (97%), making friends (78%), and the awards and recognition they received (91%). These findings are similar to the results of a previous qualitative study of BBG's CGP which also found that participants gained self-esteem (Tims 2003).

Gains in social and personal skills were benefits to participants of BBG's CGP. Participants identified learning independence, making decisions, taking responsibility, and learning patience. Socially, they gained in their ability to cooperate with adults (90%) and other children (83%), to work in teams (87%), and to accept others' ideas (85%). These recollections indicate that children's gardening programs can build positive personal characteristics in participants and benefits gained are more than participants learning gardening knowledge and skills. This information can be important to parents who seek meaningful learning experiences and activities for their children as well as for public garden administrators who seek to market and advertise beneficial aspects of their children's programs.

It is further concluded that children's gardening programs are an effective way to heighten participant's environmental awareness, especially concerning recycling, composting, littering, and the elements of a healthy environment. The largest percentage of BBG's CGP alumni stated they "learned about the importance of a clean environment" (62%). They also mentioned, "learned not to litter" (58%), "learned to make compost" (54%), and "learned how to recycle" (42%). Many schools and public gardens desire to instill an environmental awareness in their patrons and this data suggests CGP's can be an effective means to do so. Research on school gardening programs has also indicated that hands-on activities and inquiry-based learning allows children to discover their surroundings for themselves (Waliczek and Zajicek 1999; Skelly and Zajicek 1998).

Study findings suggest that the experiences and activities in children's gardening programs can help participants develop career skills, identify career interests, and in some cases lead individuals to select a career related to horticulture or environmental science. Forty-four percent of respondents felt that BBG's CGP did increase their career skills. One alumnus recalled, "I learned the value of visual arts. I now illustrate commercially, and my first published illustration was BBG's Children's Garden Cookbook which was compiled during my time in the program." Other alumni remarked how the program helped them in school with several subjects. "I was ahead of other students who took courses in horticulture and the plant sciences. My teachers were always asking me where my essentials came from, only one place- BBG." Another alumnus recalled various skills obtained in the program, "By improving my sense of responsibility, encouraging my curiosity about science and nature, and teaching me the importance of teamwork." Almost one-third (32%) of study respondents felt the experience they gained through

BBG's CGP helped them choose their career. Careers influenced by CGP participation ranged from a horticulturist to a park ranger to a caterer to a teacher. Several alumni (17%) work professionally in the horticulture industry or a closely related field including professions as landscape designer, public garden management, and state and national park ranger. One alumni mentioned, "I went on to college and studied horticulture and landscape architecture. I use the design skills, environmental awareness and scale/proportion lessons I learned at BBG everyday." This data is similar to research by Tanner (1980), Cooper-Marcus (1978), and Tims (2003) which have all indicated that children's outdoor experiences are important in the long-term development of children because they impact career choices.

In addition to participants feeling positive about their experiences and the lasting impact of BBG's CGP upon their lives, participants felt there were key components of the CGP which made it successful. These components ranged from the staff and how they made each child feel special, the programs high standards, opportunities to advance within the program, and the encouragement of friendships and teamwork. These items clearly show the important aspects of a CGP to its participants and the need to ensure that all of these elements are being met and accomplished within children's gardening programs. As schools and public gardens offer children's gardening programs, they need to design and implement these elements.

Results from this survey study document the long term value and impact of a public garden's children's gardening program upon participants' lives. While there are a number of research studies focusing on children's gardening within schools, this study, along with others (Tims 2003; Blandford 2002), identify the impact and value of having a children's gardening program within a public garden setting.

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University botanic garden as an educational resource for the Baikal region (Siberia): tangible and intangible aspects

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The Botanic Garden of the Irkutsk State University (BG ISU) is the only botanic garden in the Lake Baikal region (the World Heritage Site). It holds a collection of about 3000 species and varieties of plants, representing the flora of Baikal region, ex-USSR and other countries (Kuzevanov, Sizykh 2005). The special attention is given to introduction and cultivation of tolerant and productive plants capable to survive and grow sustainably in the severe climate in Siberia. At present, the Garden holds about 100 rare plant species from the Lake Baikal region as a "living" gene bank of species becoming extinct in their natural habitats. The conservation policy includes special measures for accumulation and propagation of rare and endangered species of regional flora as well as economically valuable plants for educational purposes.

The objective of this work was to emphasize the fact that both tangible (material) and intangible (non-material) aspects of Botanic Gardens activities are equally important for education and public awareness promotion to meet priorities of the regional sustainable development. It reflects the authors' expertise in implementation of educational ideas onto Siberian "ground" from extensive international study tours in numerous BGs of ex-USSR, Europe, USA, Africa, Asia, Australia.

The BG's activities on mobilization of new genetic resources also allow us to enrich the regional cultivated flora with economically and environmentally important plants. As a result the BG has become an exclusive source of high quality nursery-stock of plants for regional gardeners and for the world BGs network. There are many examples when the BG initiated public activities and traditions for the improvement of the green urban environment, helping to establish new "green" businesses to help poor communities to overcome poverty and unemployment, to educate illiterate people and children, and to provide people (including children at-risk and orphans) with the skills necessary for the survival in the frontier conditions of Siberia. From this point of view we consider the BG as an educational tool of the university system functioning as an active interface between natural/cultural heritage and local society. The Irkutsk State University (classical type one) is an intellectual and innovative resource for the sustainable development in the Lake Baikal area. So, the educational mission of our BG is oriented towards strategic national priorities of Russia and the region (economical growth, improvement of human well-being and quality of life, development of education, science, culture, tourism/recreation, exploration of natural resources, etc.) (Table 1).

Intangible resources including educational programs, knowledge, ideas, senses, skills, and other non-material things of BGs have much wider spectrums of end-users including not only the local ones but also international customers. The BG ISU receives monetary and non-monetary benefits through its involvement in public oriented activities and connected to research, education and commercialization of tangible and intangible resources. Feedback provides a sustainable development of the BG and, among others, supports the BG's conservational projects on environmental restoration and protection of rare and endangered plants. The roles of BGs and relative institutions in transformation of genetic resources and biological materials into monetary and no-monetary benefits raised from the use of combination of both tangible and intangible aspects of new scientific discoveries, new biotechnologies and resulted plant based products. A feedback from end-users provides a sustainability of the BG's functioning and also reflects a principle of fair and equal sharing of benefits from the biodiversity use. Local companies, authorities, institutions, nurseries, farmers, green industry enterprises, landscape designers as well as a general public in the region are main immediate consumers of the tangible resources collected and produced by BGs. It is obvious from the Table 2 that resources of BGs have a special environmental, scientific, cultural, aesthetic, and recreational importance. Both tangible and intangible resources of BGs are equally valuable for the sustainable development and linking biodiversity with public education, secure environment, nutrition, healthcare, poverty alleviation, socio-ecological and economical relations in communities, including commercialization. Therefore intangible aspects of BGs are as important as their tangible ones and they can not be discriminated in relation to human well-being and socio-economical improvement in the region. Involvement of BG in classical University education, extended and additional education for different targeted groups plays complementary dualistic roles in biodiversity conservation and ecological innovations for improvement of human well-being (Waylen 2006).

Table 1. Some aspects of using of Botanic Gardens' tangible and intangible resources for sustainable development in the Lake Baikal region in relation to current economical and political priorities

Principal priorities	Tangible resources	Intangible resources
Exploration of potential natural and other resources of the region	- economically valuable genetic resources in collections; - park zone, gardens, displays, artifacts, plant derivatives; - data base for the educational web-site	- educational programs for classical and extended university education, public awareness promotion programs (see Table 2 and Fig 1), - initiation and facilitation of public environmental activities; - mass-media and Internet
Promotion of development of innovative economy through integration of science, education and industry	- new mobilized and introduced valuable plants tolerant to severe conditions (climate, pollution); - School of Horticulture facilitating transfer and introduction of innovative technologies and knowledge; - production nurseries	- projects of city greening; - assistance in development of new "green" businesses; - commercialization of products; - linking science with industry through interpretation and trainings; - "cultivation" of environmentally minded staff for local authorities; - public awareness promotion through mass-media; - using of new information technologies for distribution of knowledge
Formation of modern/contemporary complex infrastructure for tourism and recreation	- BG's displays, gardens, facilities; - landscapes and displays outside the Botanic Garden including Siberian taiga and Lake Baikal core zone; - multilingual web-site	- programs of ecological, educational and recreational tourism - agrotourism programs; - international and joint expeditions (http://bogard.isu.ru/expeditions/lake_baikal.htm)
Nature conservation in the Lake Baikal area (World Heritage Site)	- populations of rare and endangered plants; - plant gene banks (including seed banks)	- educational and conservational programs for public awareness promotion in nature protection and in current legislation; - plant species restoration programs; - international BGs networking; - conservational web-site (http://bogard.isu.ru/cbd/redlist/redlistbaikal.htm)

A regional role of the BG depends on how successfully it links resources with local community via special educational programs. The BG ISU has several target groups of visitors: students and teachers of universities and colleges, school children, school teachers, tourists, gardeners, landscape designers, and special groups (disabled, families with young children, unemployed people, etc.). The employees of the Garden are always ready to provide excursions for visitors, free-of-charge consultations about growing, protection, and use of plants. In many cases the BGs is functioning as a gate to the virgin and beautiful nature for citizens spending most of their time in the urban environment in specific Siberian conditions. Due to the fact that the evolution of human beings was always connected with plants and their use for material and spiritual purposes, it was obvious that plants may have a good tangible and intangible influence on people. So, in addition to the formal educational programs for students and teachers at universities, colleges and high schools, the BG ISU in 1994 started development of special educational programs of continuous (extended) education for different ages and social groups (Fig. 1, Fig.3).

Table 2 Some Examples of Botanic Gardens Tangible and Intangible Resources Related to Main Aspects of Human Well-being

Aspects of human well-being	Main resources of botanic gardens	
	Tangible resources	Intangible resources
Nutrition	Genetic resources of edible plants (seeds and seedlings for gardeners); demonstration plots. Evaluation gardens and nurseries.	Basic and traditional knowledge and skills about edible plants and how to grow them. Keeping of horticultural traditions of the region.
Healthcare	Genetic resources of medicinally and cosmetically valuable plants (indigenous and introduced). Demonstration plots.	Scientific knowledge and traditional rituals, skills and recipes about cultivation and use of medicinal plants. Legends.
Financial poverty alleviation	Establishment of new 'green' businesses based on plant genetic resources.	Knowledge and skills on management of 'green' businesses including case studies enabling local livelihood alternatives, boosting income.
Community welfare, ensuring freedom and equity for all	Resources for planting trees and shrubs for city 'greening' and beautification of settlements; unlimited access to public resources of BGs for all visitors including disabled ones.	Public activities and traditions promoted by BGs; improvement of interpersonal relations in the community, friendship; transfer of sense of beauty, sense of togetherness.
Education and public awareness	Museums, displays, interpretation, signs, posters, publications, classes, training courses and guided tours, consulting facilities, computerized equipment and media, data bases, libraries, tools, instruments, etc.	Botanical and horticultural information, sharing of skills and technologies, formal and continues education, public activities, environmental propaganda via mass-media and Internet. Public awareness promotion on environmental issues and biodiversity value for human well-being.
Involvement in decision making (personal self-development, self-realization)	Documents outlining the framework of BGs structure, function and activities. Councils and Boards of Trusties, groups of volunteers.	Feeling of freedom and equity for all, an opportunity to take part at management of BG resources and activities, sense of togetherness and responsibility, democratic traditions.
Security	Special facilities and sites at the BGs (garden's complexes, displays, for example, Japanese Garden, Secluded Garden). Collections and nurseries of rare and endangered plants, restored landscapes and new populations of rescued plants in-situ.	Knowledge and skills on creation of special facilities and sites. Sense of peace, calmness, relaxation; feeling of safety, satisfaction. Understanding of BGs value for sustainable development and secure future for mankind.

The Horticultural Therapy approach based on the experience of a few world botanic gardens (the Chicago Botanic Gardens, and others) are being developed for special groups of visitors (orphaned children, disabled, kids with criminal past, older people). In case of orphaned children, the BG can play a role of the "mother" teaching kids how to use plants in the day-to-day life which is an important issue in the frontier environment (Sizykh 2001).

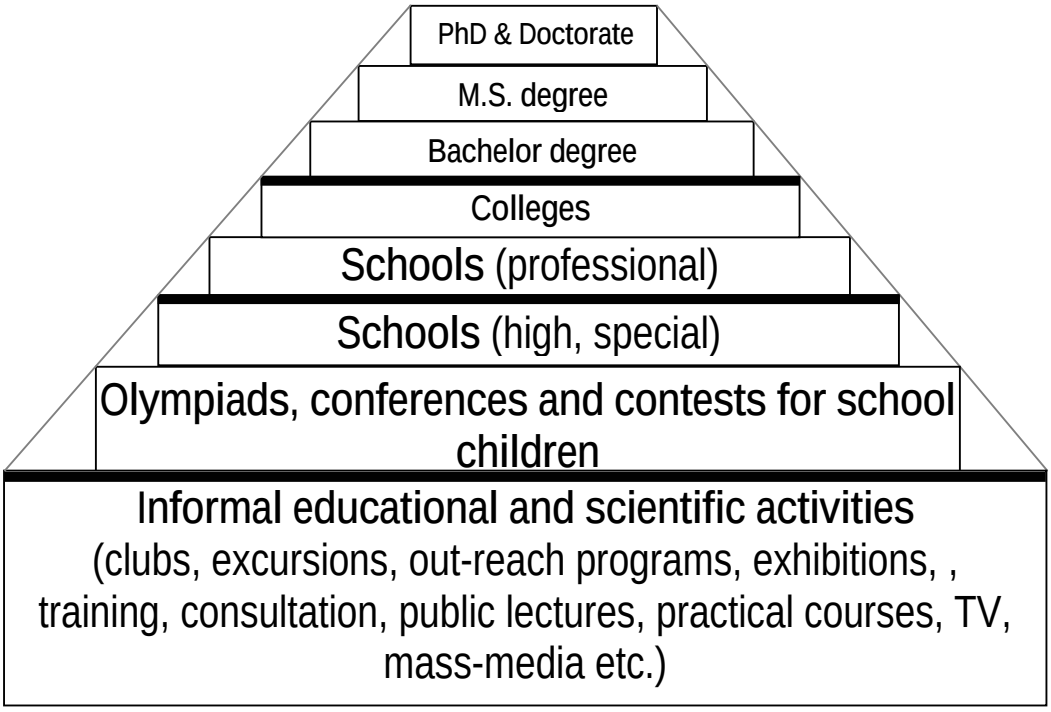

Fig. 1 Hierarchical pyramid of the use of Botanic Gardens resources for classical university education as well for extended/additional multilevel education and for the public awareness promotion in the Lake Baikal region

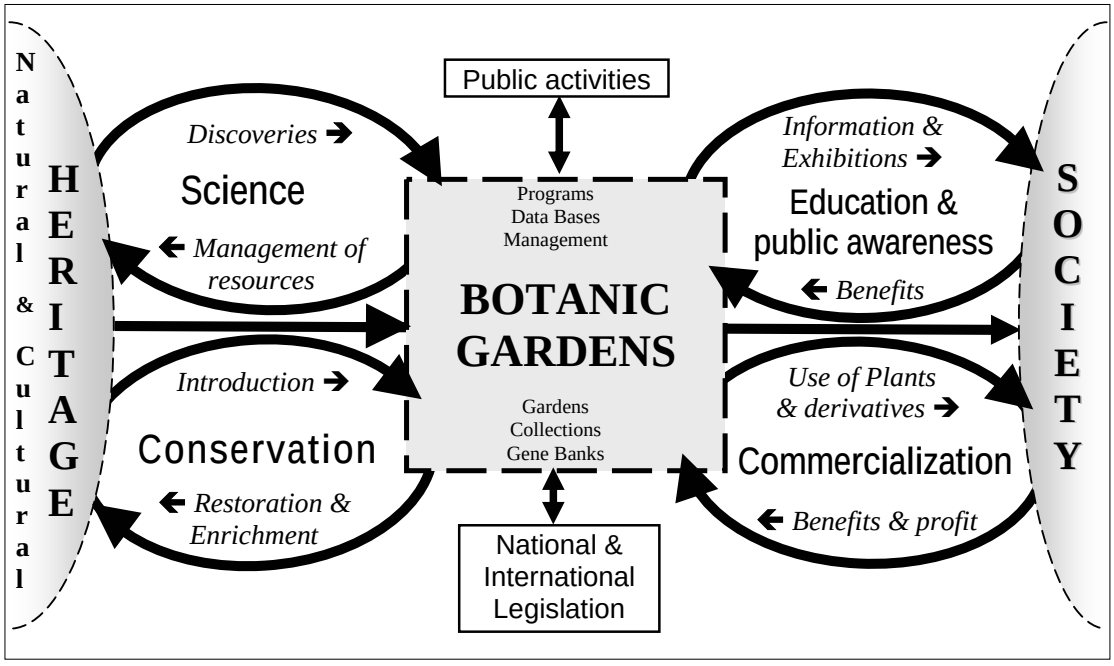

Fig. 2 Positioning of BG ISU as an intellectual and innovative resource and interface between natural/cultural heritage and regional community. Feedback balance of direct and indirect communications (arrows, connections) in management of tangible and intangible resources flows promotes the sustainable regional development

Fig. 3 Botanic Gardens of Irkutsk State University in educational actions. A) Field studies of indigenous plants, including botanical surveys, plant collecting, ecological monitoring, and environmental restoration near Lake Baikal. B) Educational courses in botany and ecology for university students and school children. C) The Horticultural Therapy program for social adaptation and correction of the social behavior of children with special needs, including disabled, orphaned children and kids with criminal history (children at-risk); D) Practical training in horticulture and botany for students

The "Horticultural Therapy" could be a good example of the implementation of non-traditional educational programs for kids who had a criminal behavior (10-14 years old) and kept in a special isolated school. Special psychological studies since 1999 revealed that the Horticultural Therapy has positive effect on social adaptation and rehabilitation of children at-risk participating in the project (Sizykh, Kuzevanov 2004). Students from universities and colleges (BSc, MSc, PhD students) (Fig.1), from the Youth Educational Centre, and from secondary public schools participate in work-study programs and in on-job trainings. Secondary schools teachers are taking special trainings and tours at the BG for their extended professional development.

Our experience proves that modern BG is not just a beautiful park or a channel for the transfer of pure knowledge and theories because such knowledge and "know-how" cannot be delivered just through books or Internet. Only through practical works and activities the BG can transfer skills and experience connected with traditions and best practices in certain regions.

In new ecological and economic conditions of globalization the role of BGs will be increased substantially due to their well developed networks, traditions of free exchange of experience and resources, direct involvement in the community and direct contacts to the nature. They are becoming an important part of regional ecologically significant resources and elements of regional productive forces for human well-being and sustainable development.

Development of any BG depends greatly on growth of its tangible resources but in case of sustainable development approach tangibles will be rather limited (the land area, the number of educational facilities and constructions, etc.). Therefore, we suppose, that development of BG's intangible resources influencing the society and the environment do not have such limitations or could be even unlimited because numerous intangible educational resources (programs, courses, lectures, tours, etc.) could be successfully based on very limited numbers of the educational material objects of the BGs.

Positioning of BG ISU as an intellectual and innovative resource and interface between natural/cultural heritage and regional community depends on harmonization of development of its tangible and intangible educational resources (Kuzevanov, Sizykh 2006). As seen in Fig. 2 the feedback arrows demonstrate the complex role of the BG activities and valuable resources of plants, knowledge and experience for sustainable development. The university BGs provides educationally useful combination of fundamental and applied science, classical and extended multilevel education, conservation/restoration of natural and cultural heritage, socio-ecological public functions, and commercialization.

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The effects of integrating field trips into science curriculum on students' achievement level of science and teachers' thoughts about science teaching: The case of botanic garden education

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Abstract

OECD (Organization for Economic Cooperation and Development) 2003 PISA (Programme for International Assessment) results showed that students in Turkey placed on the bottom of the list in terms of science. Following the announcement of results, the Ministry of Education in Turkey made an explanation about the results. It was said that the exam had measured how students use the knowledge which is gained through the interaction with the environment and how they solve the science-related problems which are encountered in daily life situations. It was also mentioned that the exam had not measured to what degree students have learned through the curriculum that was applied in all of the schools in Turkey. For this reason, Ministry of Education prepared a new science curriculum in 2004. In this study, at Nezahat Gökyiğit Botanic Garden (NGBB), a field trip program was prepared for students to apply the knowledge that they learned in plant kingdom part of the new curriculum. Moreover, it was aimed students to develop environmental consciousness through adventure games, trips to the colourful world, creative drama, discovery hours and science room activities in the field trip program. As a pilot project, this program was applied in two schools in Istanbul; one of them is from low Socio Economic Status (SES) and the other is from high SES. The evaluation of the field trip program was done by the pre and post-tests given to the students in the experimental and control groups. Furthermore, notes of the project members about thoughts of teachers who apply the program were taken into consideration. The result showed an increase in the students' achievement level and teacher motivation. The details of the results about teacher's thoughts and student achievement are stated in the rest of the paper.

Introduction

Biologists, botanists, horticulturalists, and agriculturalists have the knowledge about plant kingdom in different perspectives. However, botanic gardens still need educators for the dissemination of this knowledge. As a result, the separate location of educators requires specialty; they shouldn't only give information about the plants in a botanic garden, but these educators should also discover the effective methods which enhance students' learning and encourage them to be sensitive about their nature.

The study of Swiss Psychologist, Jean Piaget (1964) showed that "to know an object is to act on it" (p176). From the sentence of Piaget, it can be inferred that teaching plants necessitated the interaction with nature. A botanic garden, with its wide range of opportunities, can be a useful place for students to be able to observe what they learned theoretically and to get experience on the nature. Here, we should ask the question; how this experience should be? An American educational philosopher John Dewey focused on this point in 1916, before Piaget. He stated that

> "Mere activity doesn't constitute experience… To 'learn from experience' is to make a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence. Under such conditions, doing becomes a trying; an experiment with the world to find out what it is like; the undergoing becomes instruction - discovery of the connection of things (1964 p140)."

If the botanic garden education is concerned, what Dewey pointed out may be interpreted so that children, as a result of integrating with nature 'actively', try to reach the equilibrium by assimilating and accommodating the knowledge which is new to them. An educator should provide the suitable environment to children and support their discoveries with a following instruction.

PISA 2003 results also showed that there is a need for a program by which students get involved in daily life situations actively and learn through experience. In this study, it was tried to develop a field trip program integrated into science curriculum by which students actively involved in the environment. This study was started to carry out by the sponsorship of the Christensen and Ali Nihat Gökyiğit (ANG) Foundation under the consultancy of Prof. Adil Güner and Margaret Johnson. The evaluation of the program looked for the answer of the following questions;

1. Are there any significant differences on achievement level of science after students who take the field trip integrated program and those who continued usual activities?
2. Does Socio Economic Status (SES) affect the results in terms of students' achievement in science?
3. What are the views of science teachers about the field trip integrated science program?

Methodology

1. Population and sample

The population of the study was determined as the sixth grade students. This is because, students begin to learn about plant kingdom during the sixth grade according to the curricula administered by the Educational Board of Turkey (TTKB 2000). As a sample of the study, we decided to select school from two different SES; the high and low SES. SES was chosen to be the control variable

because economic status is an important factor which determines the quality of education in Turkey. These schools were selected conveniently according to their location and the relationships with the project group. Form each of these schools, one classroom was selected randomly to be the experimental group which took the field trip program and one classroom as the control group which continued their usual activities.

2. Development of field trip program integrated into formal science curriculum at NGBB

2.1. Setting up the educational goal and objectives

The main goal of the program was to introduce the plant kingdom to the sixth grade students in a way that they can enjoy while fulfilling the requirements of the science curriculum and encouraging students to be the further guides for the protection of the environment. In order to acquire knowledge on plant kingdom, the following educational objectives (MEB; TTKB, 2005) were tried to be met:

- Realize that plants are living things like animals
- Stating the main parts of flowered plants
- Stating the function of roots of plants
- Differentiating the different types of roots
- Comprehending the importance of leaves for other living organisms
- Stating the function of stems of plants
- Realizing the importance of colors of flowers for the survival of plants
- Realizing the importance of plant kingdom for the survival of all living organisms
- Stating the correct behaviors for protecting the plant kingdom

2.2. Summer school program as a preparatory phase

For piloting and experimentation of the newly created activities, a summer school was arranged. The program lasted five days and it was very intense; full of activities. The participants of the study were the thirteen students who didn't have a chance to attend any summer school program. The courses included were

- *Discovery Hour*: students went to different parts of the garden, made observations, collected fruits or vegetables, and took notes and questions by discussing with their group friends.
- *Science Room*: students observed inside of a plant by making experiments with using microscopes and different experiment materials.
- *Journey to the Colorful World*: student draw pictures on the topic of the day under the guidance of the Botany Art Instructor, Başak Güner.
- *Adventure Games*: students took role on games and repeat what they learned through exiting and joyful game.
- *Creative Drama*: student presented what they learned though a drama that they created themselves by using creative equipments mainly the waste products.

2.3. Teacher training program

For the field trip integrated science program, we arranged a "teacher training program" on September 19, 2005. The program was included the introduction of the project group, watching cd which introduces the NGBB, trip on the NGBB, introduction of the educational program, discussion on the extracurricular and in curricular activities.

Science teachers and administrators were attended to the teacher training. Before this program, we gave a teacher booklet which included guides for the student activities. In addition, we also trained the practice teachers; Defne Yabaş and Nurettin Yıldız

2.4. Field trip program integrated into formal science curriculum

After the summer school, the most effective and enjoyable activities were selected and divided into three weeks according to the order determined by the project school teachers. Every week, students completed a pre-visit activity in their schools and an activity at NGBB followed by a post-visit activity in their classrooms.

3. Instruments

3.1. Pre-test and post-test for knowledge on plants and environmental awareness measurement

Pre and the post-tests prepared for six graders from the project schools. Both the students in the experimental and the control group were given the tests in order to understand the difference which the field trip integrated education program was created. The questions on the pre-test were organized so as to match the educational objectives of the program (see part 3.1). For every question, a case was written and it was aimed to understand the students' attitude towards environmental problems and to measure their knowledge about plant kingdom. The questions were open ended and so criteria for every question developed to evaluate student performance under the guidance of the project's educational consultant. Parallel form of the pre-test was also developed in order to understand the level of change of the positive or negative effects of the botanic garden education program.

3.2. Evaluation forms for educators

An open ended evaluation forms were prepared for practice teachers to write their views on the effectiveness, and benefits or difficulties of the program for educators and students.

Findings

The experimental groups in both of the private and public schools, there is an increase in the number of students stating the parts of plant completely, relating the water intake of plants with the roots, perceived the wrong behaviors of the people as an important factor for environmental pollution. Only in the public school, an increase was seen in the number of students who stated plants as living organism

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	Percentage of students giving completely correct answer in the pre-test	Percentage of students giving completely correct answer in the post-test
School Type	**ITEM NUMBER**	
	1	
Public	42%	100%
Private	78%	78%
	2	
Public	33%	68%
Private	33%	92%
	3	
Public	12%	74%
Private	28%	76%
	9	
Public	16%	98%
Private	32%	96%

Figure 1: *Comparison of the scores experimental group for the items 1,2,3,9*

For the control group in the public school, there was not any significant change in the student scores. On the other hand, for the private school, there is an increase in the number of students stating the parts of plant completely from 35% to 55%.

Evaluation forms completed by the practice teachers showed that students especially liked the activities including games. These forms also concluded that the motivation of the students and teachers were increased along the program. Another noteworthy result was that practice teachers stated that "the increase in motivation was more obvious in the children who are from low SES".

Moreover, the practice teachers recommended that project school teachers should get more training in the garden to be ready for the activities before every implementation.

Conclusions

According to the findings of the study, botanic garden education is especially more effective for the development of basic cognitive skills. However, when the teacher evaluation forms were considered, the contribution of the program was seen for the development of affective skills for both teachers and students.

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Biography

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Lessons learnt – Evidence from practice
The use of plants and horticulture in promoting health and well-being

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Introduction
For centuries people have recognised that landscapes and plants influence mood and well-being. For example, gardens and small farms were once an important part of hospitals and although their prime purpose was to supply the institutions with food their influence on the patients' well-being was recognised (see Sempik and Aldridge 2006). Although these productive farms have now disappeared gardening is still used on a smaller scale within the area of occupational therapy (OT).

There has also been a steady growth in the number of gardens designed to provide therapeutic activity for many different vulnerable groups, particularly those with mental health problems and learning difficulties (see Sempik et al, 2005). A number of these gardens are situated within hospitals and others have links with hospital OT departments; many occupational therapists and qualified nurses are involved in this area of *therapeutic horticulture*.

The terms 'horticultural therapy', 'therapeutic horticulture' and more recently 'social and therapeutic horticulture' (STH) have been applied to this practice (see Sempik et al, 2003, p3), which, in its many forms, is used around the world. The term 'Social and Therapeutic Horticulture' (STH) is now widely used in the UK since it is recognised that social interaction plays an important role in this activity. STH can be seen as the participation by a range of vulnerable people in groups and communities whose activities are centred around horticulture and gardening. STH is distinct from domestic gardening because it operates in an organised and formalised environment.

Around 22,000[1] clients participate in STH each week and there are approximately 1,000 garden projects in the UK (see Sempik *et al*, 2005) which provide around one million sessions each year with a budget in the region of £54 million. STH is therefore an important service provision within the field of health and social care.

Researching the Benefits
Recently, there has been interest among researchers from the fields of health and social care into the use of therapeutic horticulture and STH. Consequently, STH is increasingly viewed as an effective form of social care for people with mental health problems and other difficulties (see Sempik *et al*, 2005).

There are a number of different activities and processes associated with STH, these can be broadly divided into those directly related to plants, landscape and nature; and those related

[1] A recent survey showed that this number had increased to 24,000 in 2006.

to the structure and procedures surrounding STH garden projects such as the daily routine, social opportunities and so on. All of these factors are interrelated and the overall benefit of STH may arise from the synergistic action of these components, however, the 'natural' component of STH is an essential ingredient.

There is a great deal of evidence from the field of environmental psychology that suggests that contact with plants and nature is beneficial to human well-being. For example, Ulrich *et al* (1991) have shown that views of the natural environment promote the recovery from stress and Kaplan and Kaplan (1989) have put forward a theory of *Attention Restoration*. This proposes that the natural environment can have a restorative function in enabling directed attention to recover following a period of concentration (when effort is required to exclude competing stimuli) or as a result of illness (see also Kaplan, 1995).

Observations from our research have shown that participants of STH garden projects valued the experience of plants and nature in a variety of ways and perceived it to be beneficial to their health and mood (Sempik *et al*, 2005). Many of the participants in our study spoke about their enjoyment of 'being outside' or in the 'fresh air'. This was not only due to a sense of escape from the 'inside' or 'indoors' of restrictive environments, but also of their desire to be in a natural environment with its associated colours, smells, textures and sounds. Garden environments were perceived as 'peaceful' and there was no pressure on participants. Many felt a deep personal attachment, both to nature itself and to the garden space as the embodiment of nature. Such emotions and experiences appeared to fulfil some of the participants' spiritual needs and could be viewed as 'spiritual bonds' within the context of a secular understanding of spirituality (see Sempik *et al*, 2005, pp 48-50). Many of the participants also reported that taking part in horticulture fulfilled their need to provide nurture to another living entity.

In addition to the natural dimension of STH, there is a dimension associated with the routine of attending a garden project and participating in its various and varied activities. We have examined these benefits against the interrelated frameworks of social inclusion and employment. The framework of social inclusion that we used was proposed by Burchardt *et al* (2002) and has four key dimensions, namely: *production, consumption, social interaction* and *political engagement*. We found that the benefits resulting from participation in STH were enacted through those dimensions. For example, garden projects provided opportunity for social interaction and for some participants they were the *only* points of social contact. Projects also enabled clients to be productive and to *feel* productive. Regular attendance created routine and structure and provided clients with a sense of purpose, meaning and status usually associated with employment. Clients considered themselves to be 'workers' and 'gardeners' and not patients or clients. Training in horticulture, including the use of garden tools and machinery, promoted the development of self-esteem and self-confidence. Clients viewed themselves as 'competent persons' after training and valued the knowledge that they possessed.

Research has shown that people with mental health problems and those with learning difficulties have poorer physical health than the rest of the population. For example, the mortality from natural causes, such as cardiovascular disease, is significantly greater in people from these two groups (see Harris and Barraclough, 1998). An increased level of physical activity could therefore be beneficial, however, people with mental ill health and learning difficulties are often unable to access sports and leisure facilities. Garden projects may offer an ideal opportunity for increasing the physical activity of these individuals.

Strenuous exertion is not necessary for improved physical health and the level of physical activity associated with horticulture and gardening can have benefits. Indeed, recent research also suggests that moderate physical activity may be effective in delaying the onset of dementia and Alzheimer's Disease (Rovio et al, 2005; Larson et al, 2006).

There is a substantial literature on the use of plants and gardens for people with dementia (see Sempik *et al*, 2003, pp 11-13; Sempik, 2004). Plants provide a focus for reminiscence and access to a suitably designed garden reduces the incidence of inappropriate or aggressive behaviour.

A brief case history

Some of the benefits of STH described above can be summarised in the words of one client who had worked in a senior role prior to her mental illness. No additional explanation or interpretation is necessary.

> I came here with, erm, just from very little hope. I'd, sort of, lost everything and I'd been in hospital for a long time and I didn't really see a future. But I was recommended to come here by a nurse who thought it was just the place for me, and I was lucky that, I think she must have visited the garden and knew about it. So I came on a visit and something about the place immediately engaged me. I think it was the, it was so far removed from hospital-type of services or medical-type of services and I felt that I was, on my first day here I immediately felt that I was, I was, sort of, seen as an individual and not just as a patient…
>
> One of the, sort of, first things, I guess, was that it gave me a structure to my day, and a routine, and I was glad to be able to come in for the day, everyday, five days a week because I find one of my big problems was that time was just so difficult to get through when I was feeling really bad…
>
> …I could think of myself as a gardener. Otherwise I was just a patient, somebody who suffers from a mental illness. And through coming to the garden, I was a gardener, and if people asked me what I did, there wasn't the usual awkward silence while I tried to think how to put it, but I could say that I was a gardener and talk about what I'd been doing that day.
>
> And I think if it hadn't been for the gardening, which had all this time been preparing me, building up my confidence, teaching me new skills, erm, being a, sort of, safe place for me to come while I was building things up for myself, erm, I don't think I would ever have been in a position where I could take on a job like this. And it's quite a challenging job. It's quite hard but I'm enjoying it…
>
> I really like being in touch with the earth and the seasons and the weather, and being part of the growth cycle, and, you know, coming in in the morning and wondering if your seeds have germinated yet, and whether one of your plants is flowering yet
>
> (Case history, 'Jane', adapted from Sempik *et al*, 2005, pp 73-75).

Conclusion

Social and therapeutic horticulture provides many benefits. Some of these are directly related to the use of plants and the natural setting of the activities. Others are associated with organisational, procedural and functional aspects of garden projects. Together this mosaic of effects provides benefits to the health and well-being of many vulnerable individuals and those with mental, physical and social problems.

There is still a need for more research in this field. Both to increase the understanding of the processes involved in such a multifaceted and complex intervention and also to provide supporting evidence so that practitioners and policymakers are able to make greater use of STH and to promote it as an effective and useful form of health and social care.

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Joe Sempik

Joe Sempik is a research fellow at the Centre for Child and Family Research at Loughborough University. His research interests are in the field of environment and open space and its influence on health and well-being. He has recently completed a three year study of the use of organised horticulture projects ('social and therapeutic horticulture') for promoting social inclusion for vulnerable adults, including those with mental health problems, learning difficulties and physical disabilities. He is currently carrying out a feasibility study of the use of a randomised controlled trial design for investigating the effectiveness of social and therapeutic horticulture.

Joe is also involved with other projects at the Centre, including an investigation of different therapeutic interventions used for children with behavioural problems and a study of the perceptions of social policy researchers of the criteria which define 'quality' in published research.

Joe has a PhD in physiology and pharmacology and an MSc in environmental management and worked in biomedical research before his involvement in the social sciences.

Raising awareness of local plants and their sustainable use by linking Darwin Project with the public education system in southern Tamilnadu, India

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Abstract

The Darwin project implemented by the Kodaikanal Botanic Garden (KBU) and the BGCI was aimed at raising awareness among school groups about the local plants and the need to conserve them by training Darwin mentors (primary school teachers) in the public schools of biodiversity-rich Western Ghats region in southern Tamilnadu in India. The entire hierarchical machinery in the Tamilnadu State Elementary Education Department was activated and officials of the Department supported and participated in many events associated with the project. Initially 180 teachers were trained in one of the eight three day capacity building workshops comprising lectures, games, activities, visits to disturbed and virgin forests, walk through the aboriginal trail in the KBG to familiarise with the medicinal and economic plant species of the Palni hills and demonstrations of school garden lay outs and plant propagation methods. The Darwin mentors returned to their schools and trained 984 of their colleagues in the schools. A series of activities that followed in the schools and around with the participation of teachers, school children, education officers, NGOs and local people included World Environment Day and Ozone Day celebrations, environmental campaigns in the villages, quiz and elocution competitions on environmental issues, drama dance and other cultural events in appreciation of natural resources, visit to biodiversity rich areas, establishment of herbal, aroma and nutrition gardens, composting, installation of water harvesting structures, formation of Darwin Environmental and Education Society, publication of a newsletter, a handbook on medicinal plants with resources contributed by the teachers, and a poster on medicinal plant use and award of native plants as prize to the winners of various competitions. An impact assessment visit of the Project Officer to selected schools nearly 3 years after the completion of the project confirmed the lasting impact of the project on the school children. Possibly due to the influence of the project, new lessons on medicinal plants have been recently added to the curriculum and an oath highlighting the importance of personal hygiene and cleanliness of school surroundings is being taken by the school children after morning prayer assembly every day.

Introduction

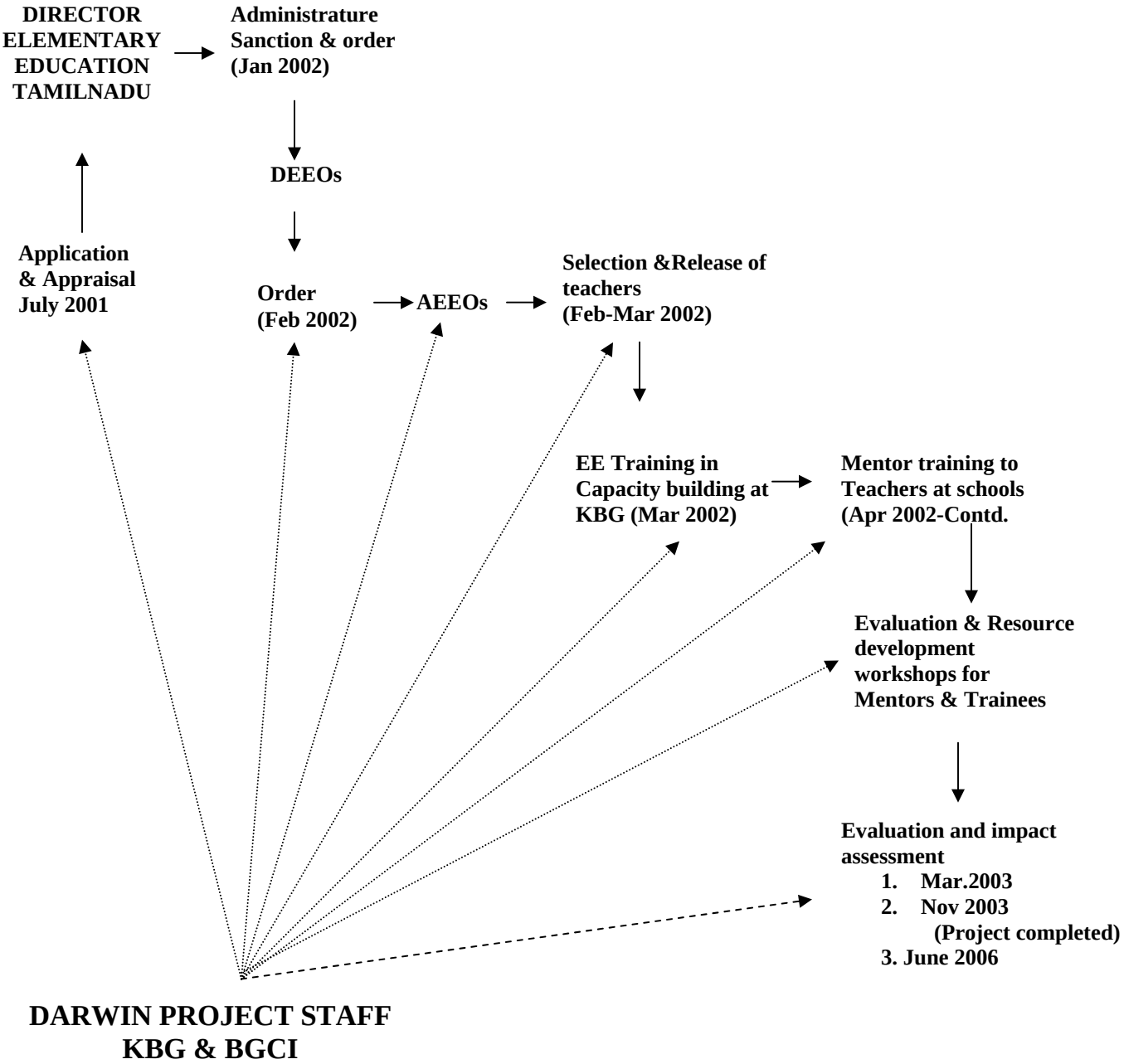
In Asia, next to China, India is the most populous country accounting for 16.2% of the world population. India is also rich in plant and animal resources, harbouring about 8.0%of the global biodiversity in 2.2% of the area. Nearly 70% of the people live in over 5,76,000 villages and the centres of the biodiversity in Eastern Himalayas and Western Ghats are flanked by the villages where impact the local biodiversity every day. The landscape of the Western Ghats particularly the Nilgiris and the Palni hills in the south is vastly changed due to anthropogenic pressures and the unique flora of the evergreen shola forests are under severe pressure from human settlements, commercial plantations, power projects, fuel wood and tourism-related developments. About 40% of the rural population in the region are illiterate; however, the children of the rural dwellers

attend the schools due to free education and noon meal schemes introduced by the State Government. The Darwin Project, **People and Plants: Training Darwin Mentors in India** was launched during 2001-2003 to influence the stake holders- the school children about conservation and sustainable utilization of local plant resources through environmental education and training to their teachers. The project was expected to create and strengthen grassroots support complementary to local governmental and non-governmental efforts to protect the remarkably diverse flora and vegetation of the Western Ghats region of Tamilnadu in general and of Palni hills in particular. It was probably the first of its kind to be implemented successfully with the support of bureaucracy ridden elementary education system to reach the unreached with maximum impact and value for money.

Findings, achievements and lessons learnt

Convincing the highly bureaucratic State Elementary Education Department of the need for EE in the schools was most challenging and was achieved through frequent visits and discussion with the Director, State Elementary Education to issue the order directing the District Elementary Education Officers (DEEOs) and local Assistant Elementary Education Officers (AEEOs) to extent support to the project in the public schools and release the teachers for training. Consequently, the otherwise obstructive junior officers proved facilitated and even participated in the school level activities of the project. This was a great motivating factor for the teachers to take up the project seriously in the schools. Implementation of a non-governmental project in government schools with the motivated administrative force and trained teachers to address EE issues to the poorest of poor students who attend the public schools in the remote biodiversity rich areas of the Western Ghats and generate awareness in partnership of officials, teachers and project staff was a lesson by itself. This model (Fig.1) could perhaps be replicated in other developing countries where similar situation exists.The official bureaucracy could not only be softened and subdued but the entire hierarchical machinery activated through personal appearances of the Project Officer and contacts established with the officials and also by organising pre-project awareness meeting and mid-course before the officials of the Education Department in each district.

Fig.1. Mode of implementation of the Darwin project by the Kodaikanal Botanic Garden and BGCI through partnership with the public education system and the teachers in Tamilnadu



Facilitation through partnership

At the time of launching the project, Kodaikanal Botanic Garden and Sacred Heart College both located at Kodaikanal were the identified partners for implementation of the project. Inadequacy

of this partnership was soon realised. In addition to the officers of the Elementary Education Department, new partners viz. NGOs (Literate Welfare Society at Theni and Palni Hills Conservation Council, Kadaikanal), State Forest Department, Youth Sports Clubs, village panchayats and municipalities and local communities played catalytic role to identify and release the teachers from the schools, organise on-site functions, campaigns and community gatherings, supply of plant saplings for school gardens, liberal donation for secondary level training and fencing the gardens in the schools and hosting lunch for the teachers and students during capacity building workshops. Although the programmes themselves were not modified, the means followed to complete them successfully by raising local support were as possible only with such major and minor partnerships at various levels. Festival like participation of the rural men and women in the school EE programmes by displaying medicinal herbs, preparation of ground for raising school garden and sharing their experience in the use of local plants in certain schools was amazing indeed!

Adoption of Triple C Formula for furtherance of project activities

After the initial capacity building workshops for Darwin Mentors, Close Continuous Contact (Triple C formula) with the officials and schoolteachers was essential for efficient follow up activities (secondary level capacity building workshops to other teachers, evaluation and resource workshops, participation of children in activities and games) in the schools. It was particularly so since even otherwise the teachers' hands were full with various assignments under the new Sarva Shiksh Abhiyan (SSA) education policy of the Government. Since the activities of both Darwin and SSA schemes overlapped, allotment of slots for the former was possible only through continuous contact and pre-appraisal of the project events in the participatory meetings of local officials and teachers. In aided private schools, non-cooperation of the Headmaster/management to release the teachers for project related activities had to be tackled in a spirit of accommodating their concerns and persuasion of the managements through discussion.

Project impacts

The impact of the EE training to the teachers was extremely positive as evident from such attributes as maintenance of clean and tidy class rooms and school premises, wilful incorporation of EE in regular classes, teaching activities and games and transfer of newly acquired knowledge about plants and the environment to the students, sensitisation of the students and to some extent the local village communities on the existing strong traditional knowledge about plants and their sustainable use and exhibition of plant species of medicinal and economic importance in school functions. Flurry of activities followed in most of the school campuses with installation of water harvesting structures, campaign against use of plastics, making pits for biocomposting of degradable wastes, outreach visits to biodiversity rich forest segments, collection and display of newspaper cuttings on environmental issues, quiz, elocution, drawing and essay competitions on plants and projects affecting the local and global environment, organisation of drama, dance and other cultural events with children participation and distribution of Neem, *Pongamia* and red sander saplings as prize for the winners of competitions. At teacher's level some of them even wondered why a foreign partner (BGCI) should take this much interest and effort to impart EE to school children of remote villages in India while others were convinced of the need and determined to conserve the valuable plants for present and future generations. Many of them appreciated the resources developed under the project and opined they would go a long way in furthering the cause of EE though in a non-formal way for sometime to come. The major outcome of the project was formation of informed groups of teachers and students in 5 districts of Tamilnadu who understand the local environmental problems and are positively disposed towards

plant resource conservation and enrichment for sustainable future. The impact on the local communities was only marginal and was not the major objective of the project.

In a scale of 0 to 100%, the approximate impact of the project at the level of various target groups was teachers: 80%, students: 90% and local communities: 20%. The impact would be close to 100% if only the interested teachers were selected for the capacity building training, since the AEEOs made the selection, participation of teachers with less than optimal interest could not be entirely avoided.

Unanticipated gains

Apart from meeting the formal requirements of the project fulfilling its objectives, several indicators of success based on unanticipated gains were evident at the end of the project

a) The resources developed by the teachers were compiled in the form of a Handbook on Medicinal Plants useful for teaching in classrooms. The book contained articles, stories and songs on several local plants mostly contributed by the teacher participants.
b) The teachers in two districts joined together and registered Darwin Environmental Education and Development Society. The DEEDS was supposed to be an important endurable achievement and a viable platform for disseminating and promoting all-round EE activities among the school groups
c) Two-way learning in the schools as teachers found new uses of plants with the help of the children and their parents during the plant exhibitions held in the schools
d) The eagerness of the teachers and students to know about local herbs and herbal preparations led to the establishment of herbal, nutritional, aroma and mixed gardens in 44 schools including those which did not participate in the training programmes.
e) Bubbling interest and voluntary contribution of articles by the teachers led to the publication of a Newsletter “Voice of Darwin Mentors”
f) Perhaps due to the influence of the Darwin project, the Government of Tamilnadu has recently introduced lessons on medicinal plants into the course curriculum of Middle Schools. Besides, an oath to maintain personal hygiene and cleanliness in school premises is being taken by the school students after morning prayer assembly in all the public schools.

Other project outputs

Altogether, during the two years 1164 teachers received training in capacity building and 370 of them received were offered training in resource development. Training materials produced for use by the teachers included an A4 leaflet about Darwin project in both English and Tamil, A4 leaflet about environmental problems in India and the information on Darwin EE project, an A4 interpretation leaflet for KBG, Tamil version of Teachers Handbook for capacity building, poster on medicinal plants for class room use in Tamil and planting materials for 44 school gardens. Publications emanated from the project included an article in Roots, another paper in the Proce.of V^{th} International Botanic Gardens and two others in local journals. Wide publicity about the project was given through 4 national press release, 12 local press releases, radio interview and local TV programmes.

Darwin identity and articles of CBD addressed by the project

The Darwin project was accepted by the teaching community and the elementary education authorities in Tamilnadu as unique in that no project of this kind was operated through the primary and middle level teachers for strengthening the case of stakeholders, the school children and their parents in an otherwise ecologically sensitive biodiversity-rich area. Darwin logo was imprinted on all the printed materials of the project and on the boards of the school gardens. There cannot be a better testimony to the identity and promotion of Darwin project than to form DEEDS by the teachers themselves for continuing the project activities beyond its expiry. Locally Darwin project was identified with native plant conservation and sustainable use of plants for human welfare.

Current status of EE in the schools

On a fact finding visit to selected 14 schools in three different districts three years after the completion of the project, both the Indian coordinator (Dr. V.S.Manickam) and Project Officer (Dr.S.Seeni) were astonished to see several of the school level activities still continue with the same vigour and participation of the teachers, children, local elementary education and panchayats officials. Even volunteers from youth wing of the Red Cross Society, and newly formed Self-Help Groups of village panchayats now spread the environmental message gathered from the schools across the village communities. The saplings planted in many school gardens have grown beyond expectations. One of the Darwin Mentors regularly handles classes on planting and rearing of medicinal plants for foresters and NGOs while the other received a certificate in appreciation of his plant exhibits in a Flower Show. Live fern exhibits were organised at ICC Middle School at Coimbatore and at Kanniwadi Panchayat School trees such as *Pongamia pinnata, Cassia fistula* and *Saraca asoka* supplied earlier are overgrown to provide shade for the children to play under. In some other schools vegetables are being regularly harvested from the garden the children raised. Special boards and labels on the importance of local plants for local people have been put up in a few schools. All these confirm the lasting influence of the Darwin project and improved awareness of the students and their teachers to continue biodiversity education and service for years to come. However, there was not much of a progress in the DEEDS-induced activities in the villages owing to poor mobilisation of funds.

Conclusion

The singular and most notable achievement of the Darwin project was that it exposed the teachers and school children to a world of plant conservation and sustainable utilization using education modules and practical activities most acceptable to the cultural and socio-economic background of the local communities in a biodiversity rich part of India. The outputs including the first time information collected from school groups anywhere in the developing world. Surpassed the aims and targets stipulated at the time of launching the project. The support extended by the project formed the basis for the teachers to form a viable platform (DEEDS) for sustaining the activities and a model for others to follow in a bureaucracy ridden education system. Apart from the school-centered activities, the green campaigns still being launched outside by the stakeholders in partnership with like-minded groups in the project area have stirred the hearts of many in the rural villages and officials of the Elementary Education Department. The initiatives of a recent IIN project in the area are bound to strengthen the hands of the local teachers further. There are indications that a revolution of some sort already in the offing will develop further to realise a greener and prosperous future.

Connecting with the community: Three levels of community-museum interaction

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Introduction

The educational programs provided by museums are grounded in the belief that museums are educational organizations for and of the people, and as such, are responsible for promoting on a large scale, citizens' knowledge of community and society. Because of the variety of contexts and circumstances in the schools and communities of our constituencies, informal education institutions cannot take a narrow approach to educational programming. Rather, we must provide programming that is accessible to different audiences and practical on an institutional level. This paper describes the approach that the Center for Teaching and Learning at the Chicago Botanic Garden has taken to promoting environmental awareness through education programming for secondary students (ages 12-18) in the Chicago metropolitan area.

As a living museum, the Garden has as its primary goal to provide citizens with education about and an appreciation for the natural environment. More specifically, for the youth audience the garden seeks to develop students' scientific literacy (AAAS 1990, National Research Council 1995), educate youth about the importance of the environment and their role in preserving it (Biodiversity Project 2002, Athman and Monroe 2002), and increase students' waning interest in the plant sciences. Because informal education institutions have the ability and responsibility serve a diverse audience we must reach and engage under-represented constituencies at multiple levels of scope and intensity. It is especially important to reach adolescent youth, who will provide the grounding for society in the future.

There are countless ways to effectively support student learning, but the choice of methods must be guided by institutional goals and the structure of the learning context. By examining three contrasting approaches to secondary environmental education that leverage public, community, and museum resources respectively, I propose one model of informal education programming that allows for a range of educational experiences for youth both within and outside museum walls.

Supporting breadth *and* depth programming

There are multiple variables to consider when choosing how to limit or expand educational programming, including material support, learning context, and target audience. First, one needs to consider the kind of material support and staffing resources available. The learning context is made up of the location, teaching resources, and type of teaching space available. The program structure must be adapted to the environment in which students will be learning. For example, students who have access to the museum collections will have a very different experience than those who participate in a museum-sponsored program that takes place at their school. Finally, the diversity *within* an audience needs to be taken into account. "Adolescent youth" as a group can be divided up into multiple sub-groups by socioeconomic status, ethnicity, or other criteria, with different programming needs. The range of programs should offer variety of channels through which youth can interact.

However, gardens need not be entirely constrained by their own limits, but can look to other organizations with similar goals for support. Community organizations and local schools can provide space and resources for a limited number of students, while at the regional level, school districts, park districts, and library systems can provide a way of effectively reaching larger numbers of students. The model presented here is grounded in this scaled partnering (figure 1). Three case studies provide a context for understanding and examples of how the model might be realized.

Case studies

The bottom of the triangle represents the broad base of the Garden's programming and one that leverages regional resources to reach large numbers of students. One example of this type of program is the Fairchild Challenge. This program, developed by the Fairchild Tropical Botanic Garden in Miami, Florida, U.S.A., is a school district-based program for students in U.S. grades 9-12 (ages 15-19). The Fairchild Challenge takes an interdisciplinary approach to environmental science by sponsoring competitions around projects in architecture, economics, education, literature, the fine arts, and sciences that promote students' awareness of environmental issues. The underlying goal of the program is to increase student's interest in science and scientific pursuits through the use of skill sets or academic strengths that are more familiar to them.

The structure of the Fairchild Challenge provides broad coverage by engaging entire schools and classes. Throughout the academic year, Chicago-area schools may participate in as many or as few of the challenges as they would like. To encourage schools participation the Challenge have been designed in collaboration with teachers so that they can be easily incorporated into existing curriculum or used independently for extensions to pre-existing lesson plans. The Garden's education staff, volunteers and facilities are available to help students research, refine and complete challenge options, but the main focus and work takes place at the student or group level within the school. Students' Challenge submissions are first screened by teachers at their participating schools. After the school screening is completed, winning entries from each school are submitted to the Chicago Botanic Garden. The Garden collects the winning entries and gathers a panel of subject experts from the community for final judging. The Garden acts as an intermediary for students and community experts and to engage everyone in increasing their environmental awareness.

This kind of collaborative large-scale programming is a cost effective way of increasing Garden visibility and introducing a new audience to its goals in positive supporting way. In this case, the Garden plays a primarily organizational role as it interacts with students at the institutional level through existing channels. The goal, represented by the blue arrow on the diagram, is to introduce students to environmental issues and engage some of them in more intensive programming the Garden offers.

This smaller group moves up the triangle to the middle level of programming (class size 20-30 students), for students who are truly interested in environmental science. Partnering with local organizations, such as community centers, youth organizations or churches, to deliver these programs provides two benefits. First and most importantly, it allows the Garden to bring their expertise directly to the community. Second, it also provides access to additional resources at the partnering organization that can enhance students' experiences.

Primero la Ciencia is a community-based summer program located in a densely Hispanic neighborhood of Chicago. It emerged as a response to an observed lack of participation by Latino

students in one of the Chicago Botanic Garden's existing on-site programs, Science First. The intent is to nurture students' natural scientific curiosity, to prepare students to take advantage of the Garden's other education programs, such as College First (discussed below), and to encourage students to pursue science in education or as a career goal. Two years of experience with Science First indicated that, while African- American students were well represented, the program failed to draw any participation from Latino students, though their presence in Chicago public schools is significant. Among other things the other barriers to interest in science education, unfamiliarity with the Garden and parental concerns over sending their children so far away from home each day acted as additional barriers to their participation.

The result was a partnership between the Garden and a well-established community center, Gads Hill Center, in the predominantly-Latino neighborhood of Pilsen. As a multi-service family resource organization that has a mission to provide comprehensive programs for children, youth, adults, and families that promote personal growth, strengthen the family unit, and develop a strong sense of community, it provided an appropriate home base for the program. Locating the program within the community helped ameliorate concerns parents had regarding sending their children 30 miles north of the city to the Garden each day. The partnership with Gads Hill Center also gave the program credibility in the community that the Garden lacked, as most program participants and their families are already active in Gads Hill programs. Through this partnership, the Garden allowed a new audience to become comfortable with the museum and as a result, has seen a significant increase in Latino representation in the Garden's on-site programming. While this approach has a higher cost per student than the broad-based programming, each student has the benefit of individual attention and more direct interaction with Garden resources and staff.

Finally, at the tip of the triangle are intensive, immersion experiences. While these programs are by necessity limited in the number of students they serve because they are dependent on organization resources, there is a very high individual payoff. The immersion experience allows students to experience actual scientific research and specific career training, which are intended to inspire them to continue their education in the sciences in college and graduate school.

The third program under consideration, College First, is an on-site full-year mentorship program for Chicago Public School students who will be the first in their family to attend college. Each year twenty students (ages 15-18) visit the garden for eight weeks to engage in group activities and one-on-one internships with Garden staff. Goals for College First are to (1) foster students' interest in science through summer apprenticeships that enliven content through active project work and field experience (2) prepare students for academic life beyond high school; and (3) increase students' awareness of college options and career opportunities in scientific and environmental fields. These goals are pursued through a balance of work opportunities in a professional environment, educational projects guided by mentors, and year-round college preparation activities.

Students spend half their time investigating science with an instructor and the other half working with a Garden professional in a particular area. During instructional time, various scientific disciplines are covered, including botany, ecology, environmental science, and aquatic science. Students engage in hands-on activities, such as journal writing, scientific observations, collecting measurements and field data, and computer-based research. College First students develop a final research project, using their work experiences to independently research a subject and present it to parents and Garden staff at the close of the eight-week summer session. The rest of the time is dedicated to the students' work commitment, for which they are paid a stipend. The work experience is also one of the most salient for the students during which students learn both science content and how to work with others.

The College First experience is rounded out with weekly field trips to laboratory sites and other opportunities to see science practiced in the field over the summer. During the school year, monthly visits to area colleges and universities take place. For these students who are the first in their families to consider college, support throughout the college application process is consistently cited as one of the most important of the program. This intensive, individualized programming can be provided for only a few of the many deserving students because of the level of human and material resources required, but the success of the program is clear in students' choices and career paths. One hundred percent of the graduates from the past 3 years of the College First program have attended college.

Summary

There are three main conclusions drawn here. First, museums must offer a range of programming that targets both a single audience but accounts for diversity within the group. This is particularly important for adolescent youth who are in the process of discovering their interests. By offering programming that allows participation at a number of different levels of involvement and intensity, it opens the possibility for students to both find new interests and explore them in depth. Second, that though museums are often non-profit or publicly supported, they do not need to be limited by their resources. Partnering with different types of community organizations, from the local church to an entire school district, offers a way of extending the reach of educational programming beyond the limitations of location and resource to reach multiple audiences at many levels. Finally, that this approach creates a continuum of learning opportunities: students can begin a relationship with the Garden in the seventh grade and continue through graduation and beyond.

Figure

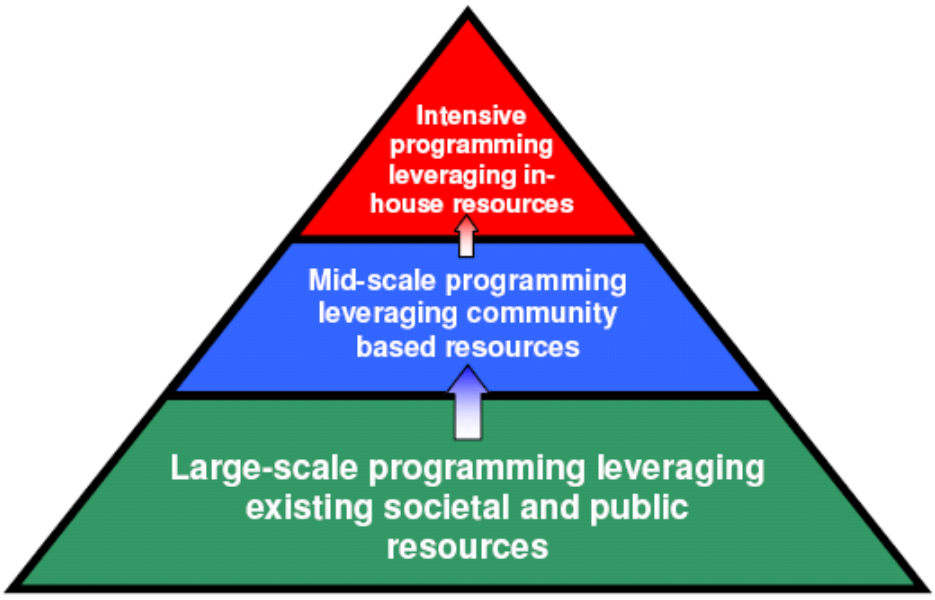

Figure 1 – 3 Phase Program Model

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Spiritual and conservation values of plant bio-diversity in Islam

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Abstract

Islam provides scientific facts on many aspects of science, including description and conservation of plant biodiversity. Variety of plants is mentioned in the Qura'n such as trees, vegetables and crops; and the diversity is expressed in growth form, color or aroma emitted by the plant. The Islamic civilization through out history till now recognizes plants as source of food, medicine, energy, beauty and pleasure. Special attention of Islamic teachings is focused on conservation of nature and natural resources including biodiversity. Spiritual, traditions and teaching values of Islam can be used effectively to mobilize the Islamic world towards conservation of plant biodiversity. This can be achieved through adoption and introduction of active curriculum on biodiversity in general and plant diversity in particular at all levels of education including: schools and universities. The public awareness towards plant biodiversity can be targeted through community institutions and mosques. The Islamic values on biodiversity can be activated in the Moslem world at national, regional levels and to share with the international community the efforts of conservation of global plant biodiversity.

Ecological balance

Balance in nature and environment was mentioned in the Qura'n and should be maintained: Allah “God” says in the Qura’n: "And the earth We have spread out (Like a carpet); set thereon Mountains firm and immovable; And produced therein all kinds of things in due balance. And We have provided therein Means of subsistence – for you And for those for whose sustenance Ye are not responsible." 19-20 Sura “Chapter” Hijr which means The Rocky Tract. Balance means that order, beauty and harmony are put by Lord Majesty “Allah”. The land is described in poetical language that it is spread out like carpet for creatures. This statement gives scientific information on environment. The Devine balance in nature (**The Natural Balance**) offers conservation of biodiversity through time without facing dangers of extinction. Rational use by human kind is the way to keep and conserve for generations, this can be developed as sustainable use of natural resources. Each natural cycle is linked and balanced in harmony with other cycles and interacts with living organisms in complementary way. More information is mentioned in the Qura'n declaring ecological Devine balance. An example of life in harmony between different organisms; relation between animals and plants: Honey bees take trees as their homes by spiritual revelation, Allah says: "And thy Lord taught the Bee to build its cells in hills, on trees and in (men's) habituations. Then to eat of all, the produce (of the earth), and find with skill the spacious paths of its Lord: there issues from within their bodies a drink of varying colors, wherein is healing for men: Verily in this a sign for those who give thought." 68-69 Surah Nahl means the bee. In botany, it is well known that honey bees are active bio-agents in plant pollination and they produce honey from plant extracts, this product is valuable as food and medicine.

Description of plant biodiversity

Allah describes diversity of plants in the Qura'n and giving range of many differences among plants as source of enjoyment and food. "Seest though not that God. Sends down rain from the sky, and leads it through springs in earth, then He causes to grow, therewith, produce of various colors: then it withers thou wilt see it grow yellow; then He makes it dry up and crumble away. Truly, in this, is a message of remembrance to men of understanding." Surah Zumar means the Crowds. The description in the Arabic text of the Qura'n is really amazing and very enjoying in language (Balaghah means art of language). In other description the gardens are mentioned as heavens and paradise of beauty: "Gardens and springs And corn fields and date palms with spathes near breaking", (Surah 147-148 Shu'ara'a means The poets) with the weight of fruit. The words of Allah continue to state: "Who make mischief in the land, And mend not (their ways). Surah, 152 Shu'ara'a, The poets. Here there is clear link between water and plants. There are many ayat (sentences) of the Qura'n inviting people of all nations and races to think and respect creatures (i.e. plants) of Allah: "See ye the seed that Ye sow in the ground? Is it ye that cause it to grow, or are We The cause. Where it our Will, We could crumble it to dry powder and ye would be left in wonderment." Surah 63-65 Waqi'a means The Inevitable Event. The meaning is a strong request from Allah to human kind to recognize the creation of all living organisms including plants by Allah and then to respect of this power and to admit the proof of God's plan and wisdom in nature. The faith and believe in Allah as God is the key of happiness to human on earth and reward by Allah to offer the man paradise after death. In clear declaration, creation of plants is mentioned: "And the earth We have spread it out, And set thereon mountains standing firm, and produced therein of beautiful growth" (in pairs) 7 – Surah Qaf is an Araic letter. The plants in the Qura'nic verses are indications of life and source pleasure and beauty, they are mercy and gift from Allah, the human life is not stable without plants, and they are means of civilization according to their advantages and technology applied to produce many things, like furniture, decoration and arts. In reference to the Prophet Mohammad teachings, plant biodiversity and agriculture was mentioned by stating that elements of agriculture include land, water and plant. The Prophet as nation leader declared that any person who save, and cultivate unused land then it is granted for him. The prophet also said: if the day of judgment is imminent soon and the man has a tree plantlet in his hand, he should plant it immediately, and Allah will reward him. The prophet advices continue to state: any plant cultivated by a Moslem and a human comes to eat from it or even an animal. There will be a reward for him from Allah.

Advantages of plants

The advantages of plants to human and other living organisms are well documented in Islamic sources:

(1) A distinctive use of plants that they are used for protection in many ways, shelter of man and animals by shadow of plants or even by active and protective chemical compounds produced by plants. Allah says: "But We cast him forth on the naked shore in a state of sickness. And We caused to grow over him a spreading plant of the Gourd kind." 145-146 Surah Saffat means Those Ranged in Ranks. The example of homes of honey bees taken in plants was explained. It can be concluded that such useful plants must be conserved.

(2) Food security: plants considered as main source of food, drink for human and grazing materials for animals. In Surah Rahman means God Most Gracious Allah says: “It is He Who has spread out the earth for his creatures. Therein is fruit and date-palms, producing spathes (enclosing dates). Also corn, with its leaves and stalk for fodder, and sweet smelling plants. Then which of the favors of your Lord will ye deny. (Sentences 10-13 Surah Rahman) . Here there is focus on plant biodiversity: the vegetable world produces fruit of various kinds and corn grains of various kinds for human food and its fodder namely straw as food for animals. Then human being should under stand to conserve plants for long periods in sustainable way.

(3) Natural medicine is based on herbal medicine which is being developed world wide as alternative medicine; the treatment of disease is concerned by medicines of plants. Moslem herbalists believe with the permission of Allah the Almighty a very grave illness can be defeated by a simple medicine extracted from a plant. This indicates the value of plants to express their advantage as disease healer. Many diseases facing the world are becoming impossible to cure as a result of man actions and disobedient to Devine Laws. This is a link of disease and humankind behavior in life. The place of herbal medicine is getting important since medical doctors would explain when a medical operation is necessary especially on heart or brain, the physician would say: the operation is dangerous and hopeless. Then what about a natural medicine to cure the disease without cutting by knife. It is well documented that, many hard and severe cases of many illnesses cured completely by medicinal plants. The idea behind that is to believe that for every disease there is a medicine from nature, then admit and respect and conserve the known and unknown treasures (i.e. medicinal plants) in nature. Human bodies belong to nature, the body components are made by the same elements of soil and plants and then medicine is available but need effort and scientific research of exploration. Supporters of natural medicine say that the world must stop using the artificial medicines since they are not made by nature and the biodiversity components, the plants for example have the machinery and factory to synthesize natural compounds as medicines.

(4) Plants are used as excellent agents for healthy life. It is amazing in Islam that water and plants are used as medicines and water is essential for plants. But first human kind must keep their bodies safe and healthy, to keep their bodies functional properly, the advice and teachings of Islam and all holy books are of great interests and we should follow the commands not to harm our bodies through abuse and excessive works. The medicines are linked to food and eating habits. Any body may drink water and it can clean the inside. He may eat grapes and it will be like a medicine. He may eat melon and it will give strength. He may eat wheat and it will give power. Life power is in every food and likewise every food is a medicine. The only condition is to say: In the Name of Allah Who created this for His servants wealth and health, this is a high spiritual value of conservation that humankind should respect nature, because The Lord created living organisms for the benefit of others including man and children of Adam. Plants are shown to have many economic advantages in the business world for investment. For example plant products can be used in healthy and cosmetic products. For example one of the prophet's habits in his life: he used a plant stick called siwak or arak with scientific name "*Salvadora persica*" in cleaning teeth as brush, for healthy mouth before and after eating and even with each prayer. The prophet asked his companions to do the same. Recent applications of healthy products used the plant's "arak" flavor and extract to produce a commercial toothpaste. Eating 7 palm dates fruit in the morning keep the person from disease and detoxify poisons in the human body. Olive oil can be eaten and used as message due to its healthy advantages. These plants are mentioned in the Qura'n with great manifestation.

(5) Plants are used as source of energy (through fire), lighting (through plant oils), clothes and furniture. The green vegetation with diversity in parks and gardens are used for relaxation and

pleasure. The Moslem civilization in Andalus (Granada and Qurtoba) of Spain established great gardens with important marks in land escaping, diversity of plants and irrigation systems. The psychological and spiritual power of believers can be strengthened through relaxation and reviving in nature and gardens. This will lead to defeat of disease by internal and spiritual power given by Allah.

Human role

The Devine command is directed to human to perform and enjoy thinking and recognition of Allah by referring to his creation of living organisms. First Allah creates man on earth and makes every thing available for all humans. Allah says: "Behold thy Lord said to the angles: I will create a vicegerent on earth." This great honor that Allah respect human to look after nature of earth and not to spoil it, man should conserve nature. This is confirmed by speech of the prophet: nature is beautiful and green and Allah make human as a care (vicegerent) and Allah is watching what human is doing. And then the meaning is a strong request from Allah to human kind to recognize the creation of all living organisms including plants by Allah and then to respect this power and to admit the proof of God's plan and wisdom in nature. Allah says: "It is He Who sends down rain from the sky, from it ye drink, and out of it (grows) the vegetation on which ye feed your cattle. With it He produces for you corn, olives, date palms, grapes, and every kind of fruit. Verily, in this is a sign for those who thought." 10-11 Surah Nahl means The Bee. God's wise is expressed through study of nature, to understand diversity and complexity of life, high degree of intelligence and deep study are required, this will lead to higher spiritual understanding to realize the marvelous gradations, colors and nuances in the creatures on this little globe of ours. The prophet said: "Each person has like kingdom and he is responsible for it and the earth is inherited by good persons" to include natural resources i.e. biodiversity. Human must be thankful for rewards and mercy offered by Allah. Man should not deceive and should not destroy nature; he must keep and conserve all natural treasures created by Allah. The prophet Mohammad said: "Nature is beautiful and green, and Allah puts human to look after earth and He (God) is watching the man what he is doing." Then man should respect this confidence of God to protect nature and keep natural balance.

Teachings & Educational values from Islam

Teachings of Islam in general is based on the following verse stated in Quran: "Ye are the best of peoples evolved for mankind, enjoining what is right, forbidding what is wrong and believing in God." One of the right and good deeds is to look after and cultivate plants and conserve them, these values can be used in education for all people. The educational principles may include the following:

(1) Faith is key element to ask believers to follow the commands and orders of God with focus on conservation and sustainable use of plant biodiversity.

(2) Transfer of knowledge to all human audiences, societies, students, sectors of community, including public. To realize that for each plant there is a function and role in life and nature. The man spends money to watch, draw or enjoy a plate of art expressing a beautiful scene, but human do not offer any effort to conserve the natural plate of art in nature, which is created by God.

(3) Follow the teachings of Allah that human must conserve and keep treasures of nature, he should not spoil, overuse, and recognize these offers, Allah says: "…It is He (Allah) who hath produced you from the earth and settled you therein …" 61 Surah: The prophet Hud . This also declares an obvious statement as a matter of fact: that the creation of man by God is made from land and its natural constituents; then man will develop his moral and spiritual nature. The prophet Mohammad declared that natural resources are offered by Allah to all humans despite nation and race or individuals, the Prophet said: "Moslems are shared in three: water, vegetation and fire as source of energy, these sources should not be sold."

(4) One side of the educational process is recognized in Islam as public awareness to include all society sectors: teachers to play important role to teach students in the curriculum, mother to teach her children, farmers, Imams through the weekly Friday prayers. All should teach, encourage and propagate the spiritual and scientific values of biodiversity in general and plants in particular.

(5) Historic, folkloric & religion values should be introduced to all teaching process. Distribution of plants in holy cities like (Mecca, Medina & Jerusalem) is distinctive in the Moslem world. Gardens of the holy places (mosques + graveyards) consist diversity of plants grown in the surroundings. Like oaks of Hebron city (city of Prophet Abraham) in Abrahami mosque, palm dates of Medina (city of Prophet Mohammad).

(6) Policy and strategy planning experts in education should include educational values in all teaching levels to conserve and reduce loss of biodiversity. The moral values in the Moslem world regarding biodiversity should be activated toward increase of social and environmental awareness, i.e. introduction of balance and sustainable use of natural resources including biodiversity. The internal and self control should be motivated in order to make the person more aware of the value of plant biodiversity and the person should watch himself what he is doing, and keeping in mind that Allah is watching and rewarding the good deeds.

(7) Religion and traditions of society: Convention on Terhal (moving of tribes in arid and desert areas) and tourism in North Africa is a good example to involve Bedouins in conservation of flora and fauna in natural habitats, religion teachings can be introduced effectively in such convention.

Audience

All sectors of the society can be targeted through professional teaching. University students can be educated through lecturers, school's students through teachers, worshipers through Imams of mosques, public through community & organization's leaders.

Role of mosques to increase public education on biodiversity

Imams (Leader of Friday prayers) can be trained by Ministries of Islamic Affairs in the Moslem World and Islamic colleges in the universities to include speeches on biodiversity in the Friday prayer held weekly in mosques. The objective could be to enhance sensation of human towards biodiversity, conservation of plant biodiversity at all natural sites, avoid excessive and over use of natural resources. The Islamic rules ask Moslems not to up root plants for nothing, Allah says: "When he (man) turns his back, his aim everywhere is to spread mischief through the earth and destroy crops and cattle. But God loveth not mischief." Such deeds are unacceptable. The living organisms are components of the natural balance; therefore they should be protected from bad actions. The speech of Qura'nic verses to humans and believers continues to highlight the

importance of natural cycles taking place in nature to keep Devine balance on earth, Allah controls all powers leading to rain fall which offers life on land when plants grow with beautiful diversity. Islam asks followers to respect creatures and protect them as a command from Allah, since mistreatment will lead imbalance of biodiversity, this should be avoided. One aspect which is related directly to human actions is the over grazing by animals, man must control and organize the grazing of animals since the green vegetation is directly affected by uncontrolled grazing. Over use of water even in washing for prayers should be avoided, this was documented and approved by the Prophet Mohammad. In Islam water is used for cleaning and purity of body from any dirty things. Pollution of water must be avoided. Recently, Moslem
Scholars and scientists adopt to treat domestic waste water to be used for irrigation.

The Imams can play a very leading and important role through the mosques, since they are referring to Quran and Sunah to convince people of all sections at once to realize and respect the value of plants in nature. The religious and spiritual values can be manipulated through skillful educators like Scholars, Imams and university lecturers. The general attitudes in Islam is to establish moral values extracted from teachings mentioned in the Quran and in the prophet words, then formulate these values in literature as documented texts to be followed by transferring knowledge to all people to reach social and ecological awareness towards nature. Since in Islam, there are no restriction on who should transfer knowledge from religion, the Imam (leader of the prayer), teacher, or university lecturer can do and teach the same values. These values which can be manipulated to conserve plant biodiversity: avoid excessive and over use of any natural resource, not to over harvest wild plant for food or medicine, therefore to be balanced, use and leave parts like seeds to produce new wild crop for next season in a sustainable practices for next generations. To teach Moslems and all people that human is created from earth and the earth respect mankind for offering food and incubator (grave) for him when death occurs. The first Khalif Abu Bakr advised the Moslem army by saying to the army leader: Do not harm palm trees, do not burn trees, do not cut fruit trees, do not slaughter animal including camel, sheep or cow unless to eat. This is famous and many important teachings can be extracted to show Islamic spiritual and ethical values for conservation of nature at time of war and peace.

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Reflection on practice: Professional renewal or additional pressure?

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Introduction

The lack of a considered and reflective commentary on botanic garden education has had a significant impact upon the visibility of botanic gardens in both policy and research arenas. In response to this low profile Willison (1997) has argued that '*by encouraging educators to question their own programmes – and even to embark on their own research – we believe that botanic gardens would be well placed to help shape the nature of the debate rather than trailing behind*' (Willison 1997 pp. 2–3). Further to Willison's argument, a major stimulus for reflecting on practice is the perceived challenge of curatorial voices which allude to education as a key role, but appear not to have a clear vision of how that role might interweave coherently across the broader scientific and horticultural remits of their gardens (Touchell and Dixon 1997, Sanders 2004). Botanic garden educators are often isolated from their peers (Foster 1997) and in many institutions have a laden portfolio of tasks. In cases like these embarking on a reflective journey may appear to be too onerous a proposition, one that might be considered an added pressure rather than a source of professional renewal. This paper considers these challenges by anchoring them in the doctoral research journey of one botanic garden practitioner.

The reflective journey

Reflecting on one's practice is a journey not without obstacles and challenges. For many botanic garden educators a key issue is that, *'a teacher researching herself is unable to determine the extent to which the effect was due to the method, her enthusiasm for the method, her rapport with her students or a host of other potential variables'* (Elliot 1991 p.110). Being an educator and researcher simultaneously can also create the challenge of developing, '*the ability to distance oneself from the struggles of the everyday experience of the classroom*' (Walford 2001 p. 113). Despite these issues, engaging in research offers opportunities to:

- question practice
- develop evaluation and research skills
- use the resultant knowledge to create a more 'evidence-informed' approach
- create a higher profile for botanic garden education across scientific and educational communities
- form 'critical friendships' with colleagues and academic partners.

Developing pedagogical dialogues

My own doctoral study considered how botanic gardens explore a range of institutional and societal identities, and more specifically, considered the role of botanic gardens in promoting their use for educational purposes. The primary question addressed by the research was: Are

botanic gardens perceived as environments for learning, or are they 'walled, stranded arks' with few key holders?'

A key finding to emerge from my study was the presence of two contrasting models of teaching and learning in botanic gardens: the student centred self-exploration model and the teacher-led didactic model. Student and teacher participants in the study (Sanders 2004) were clear in their understanding that both of these learning cultures could form part of an educational visit to a botanic garden, as were garden educators. Furthermore, evidence from historical sources affirmed the previous existence of pedagogical models of both types of teaching and learning in botanic gardens (Sanders 2004). However, despite this evidence the challenge remains in many gardens to create 'a small corner of anarchy' (Hart 2003 p.19) where children can explore and experiment freely, particularly when the dominant aesthetic is 'the orderly growing of plants' (Hart 2003 p.20). Other findings suggested that botanic gardens still struggle to adopt an educational role in ways that permeate the scientific and horticultural work of their institutions (Sanders 2004).

After conducting the study, an additional challenge presents itself, one of how data are shared and used in the botanic garden community, for as Elliot (1991) has observed, '*such data sharing promotes a reflective conversation and is at the heart of any transformation of the professional culture. But it carries the risk of bringing latent conflicts and tensions out into the open*' (p.61). Sharing the resultant data of botanic garden practitioner studies stimulates debate on pedagogical practice in botanic gardens and might even initiate deeper dialogue between practitioners and decision-makers, ultimately creating the possibility of fresh approaches to learning. In presenting this evidence to botanic garden staff it is vital that a forum between educators and horticulturalists takes place, otherwise the situation might arise where education departments are viewed as '*a thorn in the side of the institution*', as one education staff member from the study sample gardens suggested (Sanders 2004).

But how might practitioner research be fostered in a culture where educators are often isolated from their peers (Foster 1997) and dealing with demanding workloads? How can reflective practice be built into the common day? Constructing partnerships within, between and across communities can provide a solution to this professional estrangement.

The contribution of critical friends and research networks

According to McMeniman *et al.* (2000) there are two central elements to building research cultures in educational settings. The first is the existence of 'research-orientated' colleagues *within* the community, and the second is the support of *external* researchers who can offer a guiding light. By forming partnerships with external research partners and by collectively engaging in reflective practice, botanic garden educators can construct and situate a research-engaged practice more centrally in botanic garden culture, and through this develop a stronger body of evidence on the impacts of education within botanic garden settings.

During my own doctoral journey I participated in a UK regional environmental research network called FERN, which had extensive links with Danish and Swedish researcher groups. In addition I developed a 'critical friendship' with a botanic garden colleague also conducting post-graduate research. Costa and Kallick (1993) define a critical friend as 'a trusted person who asks provocative questions, takes time to fully understand the context of the work presented and the outcomes that the person or group is working towards, an advocate for the success of the project' (p. 50).

By conducting research, engaging in research networks and participating in 'critical friendships' I would suggest that it is possible to develop a wider sense of professional practice and that, over time, this can be transformed into a reinvigorated professional identity.

A vision of learning

If botanic gardens are to play a more prominent role in the learning communities of the future (Sanders in review), then education policy-makers need to be provided with evidence on how the botanic garden can offer a vision of learning that aligns with current policy developments, critical to this provision is the need for botanic garden leaders and educators to keep themselves informed of the contributions that their gardens can make; research evidence can inform these practice/policy conversations (Saunders 2004).

If 'today one of the strongest calls is for botanic gardens to be educational' (Given 1997 p.90 in Touchell and Dixon) then reflection on practice, in the form of empirical evidence and theoretical perspectives, is vital to further institutional debate both within and between botanic gardens. Creating practitioner and researcher networks, which strengthen the capability of lone educator/researchers to conduct studies, are an important element of moving from a community dominated by tacit knowledge to one which is research-engaged.

Since Willison made her comments there has been a steady rise in educational research activities in botanic gardens around the world, conducted by teacher/researchers working in these gardens. However, individual practitioners working towards postgraduate degrees have predominantly carried out these studies. Therefore, how their studies could be used by botanic gardens has yet to be fully determined. Nevertheless, it is important to document this shift and celebrate the continuation of Willison's 'encouraging signs' (1997) of practitioner research. But there are still many questions to be explored in this unique context and little study, with a few exceptions (Tunnicliffe 2001) has been conducted by external researchers.

A critical question to emerge from my study and one that could be explored by future research is; to what extent is botanic garden learning supporting or challenging the learning pupils undertake in the classroom? Furthermore, how is this learning integrated into pupils' indoor learning and *visa versa* (after Rickinson et al 2004).

Conclusion

In conclusion, I suggest that much work still needs to be done, both within individual gardens and by the botanic garden networks, to develop a more research-engaged practice. Garden management plans need to be conceptualised in ways that value educational research both as a practice and as a body of knowledge. Greater attention could be given to educators' individual development plans to embrace research as part of their roles. Networks could assist individuals support each other as 'critical friends' and catalyse connections with external academic partners. With these kinds of support frameworks in place practitioners might then find that reflective practice is a source of professional renewal rather than an onerous proposition.

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Conservation and education programmes on plants at Coimbatore Zoological Park Botanical Garden, Coimbatore, Tamil Nadu, India

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Introduction

The Coimbatore Zoological Park Society (CZP) was established in 1986 and is located at Anaikatty (1106' N, 76045'E), 30 km west of Coimbatore, South India occupying an area of 100 hectares at an altitude of 650 meters above mean sea level. The objectives of the CZP, stem from their members scientific and ethical concerns & interests. Originally, the Society had planned a typical zoological park, but soon thereafter, Central Zoo Authority (CZA) members and advisors perceived that the social and educational requirements of the community had evolved, and required a more relevant facility. Accordingly, the scope and direction of the project is now envisioned as a holistic environmental complex the Nilgiri Biosphere Conservation Park (NBCP) was born. The CZP botanical garden project started in September 1992, with an ambitious and detailed concept plan for collection of appropriate plants, preparation of the site and recreating the different vegetation types, which are found in the Nilgiri Biosphere Reserve (NBR) which covers 5520 sq.km in the Western Ghats, and also it is one of the two designated biodiversity hotspots of India. The botanical garden will be a true replica of the NBR, focusing on the conservation and education of its flora and fauna (Ashraf, 2000 and Walker et al, 2004). This botanical garden is a place for the purpose of scientific, research, conservation, display, education and interpretation center for the Nilgiri Biosphere Reserve and thus it fits well with the definition of International Agenda for Botanic Gardens Conservation (Wyse Jackson, 1999). When the project is complete it is expected to be a role model in the conservation of endemic and endangered flora and fauna of the NBR.

Botanical Gardens in India and Conservation Initiatives

At present there are 150 botanic gardens in India. The size and activity of the gardens varies greatly. Many of the botanic gardens were established for the purpose of introducing and acclimatizing economically important plants. Most of the botanical gardens in India serve to provide recreation to local communities and visitors and are valued more for their aesthetic qualities than for the role that they play in botanic education. Under the BGCI a networking was established in 2003 by the National Botanical Research Institute (NBRI) Lucknow, for promoting plants conservation initiatives and build the capacity of Indian Botanic Garden and associated organizations.

At CZP botanical garden activities such as research, conservation and projects on education are ongoing activities and are undertaken in collaboration with local, national as well as international institutes like Forest Department, Bharathiyar University and its affiliated colleges Center for Environment Education (CEE) and Zoo Outreach Organization (ZOO). The CZP botanical garden is trying to achieve the International strategies for biodiversity conservation and sustainable living (CBD Agenda 21, International Agenda for Conservation in Botanic Gardens). This also aims at

the Global Strategy for Plants Conservation (GSPC) target for the year 2010 that includes: Understanding and documenting plant diversity, conservation of plants, sustainable use of plants, promoting education and awareness about plant conservation.

The 2005 edition of the World Zoo and Aquarium Conservation Strategy has its theme the concept of "integrated conservation". The CZP botanical garden will be the embodiment of integrated conservation, and it is evident from the fact that the Botanic Garden has 534 species of plants of the NBR, of which 40 of them are endemic and 10 threatened with extinction in the wild.

About CZP Botanical Garden

The CZP Botanical Garden is situated on the eastern slopes of the Nilgiri hills, surrounded by the Nilgiri Biosphere Reserve, Western Ghats, Southern India. The NBR, rich in endemism, is perhaps the most widely known mountain part of the Western Ghats. South Indian forest types in the NBR constitutes eight thematic vegetation zones: Evergreen Zone, Semi-evergreen Zones, Moist Deciduous Zone, Dry Deciduous Zone (with three belts of moist teak Forest, Bamboo Brakes) Mixed Deciduous Forest, Rain Shadow Zone, Montane Shola Zone and Thorn Forest Zone. The CZP botanical garden is recreating the NBR, with the native plants. In future the animals, native to the NBR, will be exhibited into the appropriate zone.

Since inception, CZP Botanical garden has been planting rare and endemic trees of NBR The CZP botanical garden as of December 2005, has 534 species of 2,00,020 plants, of these 370 consists of 20,000 seedlings that are well established in the field. The Botanical garden has more plants indigenous to the Nilgiri Biosphere Reserve than any other plant conservation centre in this region (Walker *et al*, 2004). This has tremendous educational value for the forestry personnel, researcher, teachers, school and college students. Collection of plants from various Research Institutes, Forest Departments and NGO's has helped us to maintain more such indigenous plants to the NBR than any other plant conservation organization in the country.

As of now the garden is used to interpret the conservation issues to the public, about plants and animals. The CZP with the collaborating institutes has organized a series of awareness programmes involving a broad group of audience, both in the garden as well as in educational institutes at the vicinity of the site as well as in the city.

Activities of the CZP Botanical Garden

Conservation efforts

Conservation education workshops, one on Botanical education and the other on invertebrates and amphibians conservation, were organized in 1995. The Botanic Education workshop was aimed to bring together zoos, botanical gardens, forest department, research institutions and NGOs under a common forum so that they can collectively benefit and work on matters concerning plant diversity. The workshop was organized by ZOO, BGCI in collaboration with CZP and British High Commission. With the support from Durrell Wildlife Conservation Trust, Conservation education of the invertebrates and amphibians of the Anaikatty region has been undertaken in 1997. Through this project we could able to motivate the visitors about the need for conservation of local fauna. The inventory survey of fauna and flora was done during 1992-1995, and a research project on the pests and diseases of Forest Plantations in collaboration with the Bharathiyar University, Coimbatore was carried out in 1998. The study investigated the prevalence and intensity of pests and diseases of plants at the zoo. The findings were helpful in

formulating appropriate pest and disease control measures. The project site supports 110 species of birds, 18 species of reptiles, 24 species of amphibian's 360 species of invertebrates, 12 species of mammals and 60 species of plants. Almost after 10 years we could able to see some changes in faunal composition of the site. The increase in number of bird species, butterflies and invertebrates were documented. Elephants visit during summer in search of fodder plants and water was very well documented.

Plant Record keeping system

Management and exchange of information pertaining to conservation collection and related programmes are a vital necessity for botanic gardens and it provides an opportunity to demonstrate the complex interrelationship between plants and the environment. Regular botanical research is conducted in collaboration with Botanical Survey of India, Southern Circle, which includes systematic collection, protection, propagation, and planting to recreate the different forest types. Documentation and management to cope up with the enormous quantity of data generated by day-to-day botanic activities records is maintained in the ENTADA software, which is named after India longest climber *Entada rheedi*. This data would be later fed into the BG recorder. Germination studies have shown that 40 species of rainforest endemics and endangered species have propagated successfully, many of which for the first time in *ex-situ* condition. Records are maintained on all parameters of the germination process. Seeds are subjected to various methods of treatment for studying their germination success. Sometimes, the germination success of seeds collected from wild civet scats, elephant dung and hornbill droppings are investigated and compared with that of untreated seeds.

Awareness programme

The CZP botanic gardens act as a resource center for learning various environmental related issues and biodiversity conservation. Mostly students and teachers are making use of it for their curriculum and nature education trips. In June 1998, the first ever -botanic education tour to Tropical Rainforest ecosystem was conducted, and the beneficiaries were 40 school students from Tirupur, sponsored by CEE.

From 1998 to 2005 the plantation attracted 250 in-service Range Officer trainees from State Forest Service College, Coimbatore. Their visit was to know more about plant identification, propagation techniques and conservation measures.

Last seven years we have been conducting wildlife quiz contest emphasizing the theme of biodiversity conservation for the colleges in and around Coimbatore city. About 3000 students of 30 colleges were participated in this and greatly benefited from it.

During February 2003, ZOO and Wildlife Conservation Society in collaboration with CZP organized Teachers for Tigers workshop. Forty teachers from various schools took part in the workshop. As part of the workshop one-day field trip was organized to CZP botanical garden. This was mainly to show them the various vegetation types recreated and its importance in the forest ecosystem.

BGCI Project

In recognition of plants conservation efforts of CZP, a grant has been awarded by Botanical

Garden Conservation International (BGCI) Investing in Nature India, as part of the National Plant Conservation programme through the National Botanical Research Institute (NBRI) Lucknow, is a National Coordinating Institute for India. The project began in February, 2004 for establishing of arboretum for 100 Endemic and Endangered plants of the NBR, standardization of the nursery techniques for propagation of endemic and endangered taxon, field demonstration about the relationship that plants have developed with their environment and functioning as an interpretation center for plant identification, conservation and utilitarian values and potentials.

Achievement of BGCI Project

(1) Establishment of arboretum for 77 species of NBR plants at the CZP botanical garden. This will serve as gene pool for the RET species of the NBR.

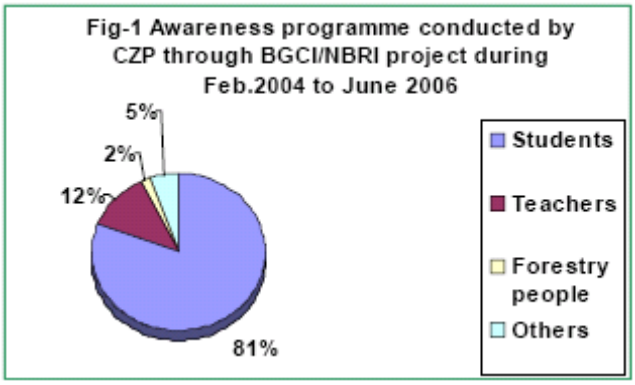
(2) Standardization of the nursery techniques for 22 species was studied in depth.

(3) Establishment of an interpretation center at CZP botanical garden and field demo on adaptive modification in plants for visitors

The CZP botanical garden has been encouraging students from National Service Scheme and Nature Clubs of various institutions to plant seedlings at the site, so that they develop a personal attachment towards environmental concerns. Visitors were explained about the need for biodiversity conservation, endemic and endangered plants and animals of the NBR and the causes for its decline. Education and raising public awareness was recognized as a key area to ensure the conservation of biodiversity for the future- and in this regard botanical gardens have a crucial role to play.

Plants conservation education programme for school students

The BGCI project envisioned exposing more students and public to botanical diversity of the NBR, and providing them hands-on experience in plant propagation methods. Visitors are explained about bio-geographic zones of NBR, endemic plants, the plant - animal interaction and seed dispersal in a forest. Nature trails around the hillocks are organized as part of the visit. During the trail the adaptive modification of leaves, stem of different tree species were Plants conservation education programme for school students shown to them. The educational material sponsored by ZOO/BGCI/Chester Zoo was made our task easy to brief them. Tree bark posters and booklet pertaining to five different kinds of trees such as coconut, rattan, cactus, birch and pine are used during the programme to help the participants to learn more about plants. Bark posters which have been designed to be wrapped around man –made objects to make them look like plants, Based on the materials, games such as adaptive modification of trees, role in the ecosystem and its uses to mankind were explained. Student's aptitudes were assessed through the quiz competition after the nature trail. At the end students were encouraged to plant tree which would in turn give them a sense of personal attachment, translating to plant conservation. Through this programme a total of 3200 people were trained during the project period (Fig.1).



The Herbal Garden developed by CZP at a local school was a successful effort to promote the medicinal plants conservation among students. This resulted in making home gardens by the students. With the support from ZOO "Plants for Life" events was organized on selected schools during special occasions such World Environment Day, World Earth Day etc., We were able to visit 5 institutions to deliver special talks, organized quiz and games related to plants conservation.


Herbal Garden developed by CZP Botanical Garden at local school

Local support

Success of any conservation project lie with the support we receive from local and public. In recognition of our plant conservation work, the local corporate sector has come forward to support our plants conservation initiatives. Schools, colleges and NGOs extending their support by bringing students to our botanical garden for nature education, trek and curriculum based education. In the light of the above CZP garden fulfilling GSPC Target 14. Visitors to the botanic gardens are learning not only about plants also about the biodiversity of garden, and conservation related issues. So far 22 institutions visited the Botanical Garden, during the BGCI project period, among this 12 schools have started eco clubs after their visit to the garden.

Networking

As per the GSPC Target 16, networking with the botanical gardens for plants conservation is vital. We were able to establish network between 12 gardens in South India, we visit these gardens to know each other's work, sharing of information and exchange of plant materials.

Future Plan

Conservation of endemic and threatened plants will be regular feature of CZP botanical garden supported by research and education. The CZP botanical garden has played an important role in implementing the international strategies. In the coming years the garden will serve as an educational, recreation spot with environmental education as the central theme.

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Education in botanic gardens in Bangladesh: Prospects and problems

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Introduction

Bangladesh has been striving hard to achieve economic progress since independence in 1971, but its high population pressure and poor resource-base have made it impossible to achieve such progress. Now it ranks as the world's eighth and Asia's fifth most populous country with a land area of 147 570 sq km resulting in a population density of about 948 per km^2 which is the highest in the world. According to recent report, the human population of Bangladesh stands at about 140 million and is expected to reach approximately 225 million by 2050. Almost all the people, particularly the rural people are directly dependent on the continued productivity of natural resources, like water, soils, forests and fisheries. But the overuse by the extremely high population pressures has degraded the natural resources in to severe soil erosion, soil nutrient depletion and widespread deforestation. The degradation of natural resources, particularly the plant resources has been a great concern for socio-economic and sustainable development of the country (UNCED 1991).

Diversity of plants in Bangladesh

Bangladesh is unique in having a wide variety of plant species with enormous genetic diversity. About 5700 species of higher plants have been recorded so far (Hossain 1995), and of these some 260 species are used as crops (Mondal 1990). The rest of the species are virtually left on growing in natural forests, village thickets and jungles which have been important sources of fruit and nuts, fuel and fodder, medicinal plants, bamboo, rattans, palms, ornamentals and aromatics. Some 60 species of both minor and underutilized fruit and nut species are common in natural vegetations which are locally being consumed as food (Das 1987). More than 600 wild medicinal plant species are potentially being used for human ailments and veterinary medicines. There are 18 species of bamboo, 20 species of palm and 8 species of rattans are occurring both wild in the forest and cultivated in rural households (Alam 1990). Numerous other wild resource species, eg. orchids, bromeliads, anthuriums, heliconias, cacti are also abundant in the forests and village jungles.

Depletion of plant genetic resources

Flora of Bangladesh is still poorly studied and so there remains a serious lack of information on the rare and endangered species. However, it has been reported that some 45 forestry species are currently threatened with extinction (Khan 1995), and many other important forest species are now are at risk of being lost in all or part of their distribution ranges because of reduction in their population number and loss of habitats. A large number of medicinal plants and other wild resource species are reported to be disappearing rapidly in Bangladesh due to destruction of natural habitats (FAO 1994). Walter (1998) reported that 24 vascular plant species have been threatened in Bangladesh of which 1 species is extinct/endangered, 21 species vulnerable, 1 rare

and 1 indeterminate. The Bangladesh National Herbarium also listed 106 plant spp. as endangered (Khan 2001). Another 23 vascular tree spp. have been reported as rare and threatened (Das 2001). The threat of extinction is mainly brought about by the degradation and encroachment of habitats due to rapid industrialization and urbanization, illegal grabbing of forest land and unsustainable harvesting of wild species

Conservation status of plants

In situ conservation

At present there are 15 protected areas for *in situ* conservation under the management of Forest Department. The protected areas are spread almost all over the country covering an area of 240 606.0 ha. According to IUCN categories of protected areas, there are 7 national parks, 7 wildlife sanctuary and 1 game reserve.

Ex situ conservation

There are, at present 3 Botanical Gardens, 3 Eco-parks and 1 Safari park under the management of Forest Department for *ex situ* conservation. Bangladesh Forest Research Institute has also established 2 preservation plots for conservation of 17 endangered tree species, 2 clone banks and arboretum for bamboo, cane and medicinal plants in different places of Chittagong district. Plant Genetic Resources Division of Bangladesh Agricultural Research Institute (BARI) and the Bangladesh Agricultural Development Cooperation (BADC) have established field stands for conservation of minor fruit spp. in various sub-station farms. Bangladesh Tea Research Institute (BTRI) has been given the responsibility for conservation of tea and coffee genetic resources, and Sugarcane Research Institute (SRI) for conservation of sugar crops. Beside these, there are a number of botanical gardens associated with the universities and research institutes and small city parks under the control and management of City Corporation and Municipal Committee.

Considering the threats on plant species, particularly with changing concept after the proclamation adopted in the Convention on Biological Diversity (CBD) in 1992, conservation has been the most important agenda of most *in situ* and *ex situ* centres in Bangladesh. But unfortunately the protection and conservation activities has been ineffective and arrested in most protected areas (*in situ*) due to indiscriminate cutting of trees and encroachments. At present the rate of deforestation is very high and, I think, this will continue unabated. As the natural habitat is disappearing rapidly, *ex situ* conservation of rare and endangered species in botanic gardens is gaining greater relevance as they contribute as the safest refuge to the preservation of gene pools of indigenous flora. So, *ex situ* conservation has become an important tool for promotion and maintaining of species and genetic diversity of plants, and thus, it has become a last resort for many species that would otherwise extinct out as their habitat is destroyed. Apart from conservation, botanic gardens can also play a vital role in educating the visitors and the general public on sustainable development and conservation through undertaking education programmes. Education programmes can be effective tools for disseminating information, knowledge and awareness raising about the plants and their importance for conservation. But the botanic gardens have been underutilized as they have been suffering from many weaknesses and limitations related to conservation and education. Among others, these are - (a) poor resource base, (b) lack of coordination and networking, (c) lack of trained manpower, (d) poor data management and information systems, etc. The botanic gardens are involved in conservation activities without having a common strategic conservation action plan and guidelines, and having no linkage and coordination among them. As a result, botanic garden activities have been ineffective, and there

are unnecessary and unplanned redundancies. Also the documentation and data management systems have been very poor, and there remains a serious lack of information on what the rare and endangered species, and commonly or abundantly available species they hold. Education programme has also been very poor and almost nonexistent in most botanic gardens due to lack of knowledge and logistics.

Bangladesh, along with most other countries of the world has signed and ratified the 1992 Convention on Biological Diversity (CBD) accepting its provision and agreeing to work towards conservation and education on biodiversity for sustainable development. So, some steps need to be taken immediately for contributing and achieving the objectives of the *International Agenda for Botanic Gardens in Conservation* and as a contribution towards the *Global Strategy for Plant Conservation* (GSPC). The steps are:

(1) Documentation and inventorying of plant holdings of botanic gardens

An inventory of the live collections of plant genetic resources (PGR) is important to know what is conserved where. But the plant holdings of the botanic gardens and the *ex situ* centres are not well inventoried and documented, and so there is a serious lack of information on the *ex situ* genetic resources they contain. In the absence of such documentation, the value of PGR conservation is expected to be reduced to users of genetic resources, as these are not known to them. So, inventorying of plant collections is most important that will help demonstrate the amount of genetic diversity contain in the *ex situ* populations. This will also help to look for the gaps to plan future collecting activities.

(2) Computerized data management and information system:

Modern techniques of data management system enable a much better control of the information relating to PGR activities. Botanic gardens in many countries are increasingly placing their collection records onto database to make use of the computerized information about sources of germplasm. But in Bangladesh, computerized database for germplasm collection has not yet been developed. Information on PGR, like passport data, evaluation data, characterization data etc are now maintained manually in register, which is at all not user oriented. So, computerized data management system is expected to help exchange/dissemination of information in a better way with users of germplasm, in country and abroad.

(3) Networking of botanic gardens

Networking of botanic gardens and *in situ* conservation centres will play an extremely valuable role in developing and strengthening conservation activities. It can be most effective tool in building new capacity for conservation, policy development, documentation and exchange of information and resources.

(4) Education and awareness on plant diversity and conservation

Education and awareness raising programmes can play important role in improving the capacity of people to address environment and conservation issues. So, the botanic gardens need to reorient and organize education programmes that can address topics including development issues, invasive threats, the relationship between people and plant conservation, sustainable living and the value of biodiversity etc. A variety of techniques may be adopted to convey the messages from guided tours, cultural activities, exhibiting and displaying plant collections, etc. Education programmes may include:

a) **Student education programme:** This education program is aimed to provide support to class room teaching of the students and teachers from the school, colleges and universities using the botanic gardens for the physical study of the diversity of plant species and related information from the well identified and well organized germplasm collection.
b) **Public education programme:** This program aims to develop awareness among the general visitors on the importance of plants and the need for conservation through exhibiting and displaying plant species as live class rooms.
c) **Training for the botanic garden staff:** Short training courses may be organized on different aspects of botanic gardens for the educators, managers/supervisors of the botanic gardens of the country to strengthen knowledge and skills on conservation and education programmes.
d) **Outreach education programme:** Outreach education programmes may be developed for the students and teachers of schools to help them develop plans for using the botanic gardens as their outdoor class rooms for raising awareness on plants, environment and conservation.

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Biography

Prof Rahman obtained his M S.degree from the Bangladesh Agricultural University, Mymensingh, Bangladesh. He attended a year-long training course on Micropropagation and Plant Tissue Culture in Wye College, London. He wants to enhance botanic gardens movement for plant conservation and education.

Education for reconnection: The power of the arts as an educational tool for students of the environment

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Abstract

The education of landscape managers and horticulturists is vital to the creation, management and enjoyment of the vibrant parks and botanical gardens, the gems of many cities, which provide such a valuable resource for increasingly urban populations. It is important that those entering these careers have a sensitivity for the environments they look after, and have the ability to find imaginative ways by which these gardens can communicate, allowing people to reconnect to the natural world. In addition they need to be aware that these semi-public places will have a special meaning to those who view or use them. At Writtle College, Essex (U.K.), students come from a huge range of backgrounds, ages and life experiences. They join the academic community to more fully appreciate how we interact with our environment and how that same environment needs to be managed for aesthetic, leisure and productive purposes. Many of the courses, even those in design, have a science basis and follow the accepted principles of a subject, but exciting and challenging situations are provided by the addition of the arts to the curriculum, often in the form of an Artist in Residence. These artists are encouraged to engage with the students and other members of the College community in order to encourage them to see the world in new ways, to help attune our students with a greater sensitivity to their environment and promote creative and questioning minds.

Developing new talent – The institution

Writtle College is a small, but thriving part of Britain's Higher Education provision, which has specialised for over a hundred years in the needs of the land based industries, including agriculture and horticulture, but now has moved beyond those traditional boundaries to embrace areas such as the design, leisure management, adventure tourism and equine studies. At the heart of the College's academic life are education, research and consultancy activities which consider aspects of how we manage our environment for aesthetic, leisure and productive purposes.

Academic provision at the College has traditionally been based on a scientific approach and this has permeated the institution. An understanding of science, in its varied disciplines, has a vital part to play in understanding how things work when approaching both technology and the natural world, but students also need to appreciate the impact of this knowledge through its application. The students as the future custodians of a whole range of landscapes, from farms to inner city parks, need to be attuned to the fact that their actions will affect all those that use or view these places. It is, therefore, imperative that they go beyond the application of techniques in managing landscapes to appreciate the qualities of a place in aesthetic, cultural and social terms, to explore the meaning a space may have in society, the characteristic that have or might make it special, to be skilled and thoughtful observers. Urban and rural landscapes are multifunctional with the need to enrich the lives of those who use them both in economic and social terms.

Developing new talent – The players

Students come to the College from a wide variety of cultural and ethnic backgrounds and spanning a range of ages, but what many have in common is that they are from an urban environment. Despite their interest in landscapes they may be somewhat divorced from the processes of the natural environment. This 'apartness' from nature, which has historic roots in the urbanisation following the industrial revolution in Britain, means that the use of the arts can help to reconnect people with the natural world, a means recently recognised by English Nature (Lincoln 2004).

At Writtle College we have used the work of environmental artists such as Andy Goldsworthy, Chris Drury, Serena de la Hey, Clare Wilks and many others to inspire students. Environmental artworks are frequently a response to a particular place, season or time of day, and students consider how the ephemeral nature of the work mirrors the natural processes they will be working with in their future careers. Students do not just discuss images of these artworks but create their own pieces as responses to a sense of place, or natural cycle, Figure 1.

Figure 1: Student work exploring daily change with the shadow of Ginkgo biloba.

Initially artworks were undertaken with horticultural students to help them appreciate how they might gain a different audience for parks and garden and how this audience might engage with the landscape. The students immediately seized upon the opportunity to express themselves and explore their environment through sculpture, the positive reaction and high levels of motivation resulted in the initiative being extended. Now a range of students are involved from landscape management and design, to leisure management, interior design and even animal science.

Creating In the public eye

Students working under the gaze of the College community rapidly found that their artworks provoked a reaction from others. This has enabled students to both witness and appreciate how their actions in changing the surroundings of others will illicit a response, a useful lesson for future professional designers and landscape managers. These reactions can be relatively passive with the passing of a comment or a question, to the mimicking of what has been achieved by the appearance of additional spontaneous artworks, Figure 2, the most obvious responses bring about the destruction of the works, Figure 3.

Figure 2: 'The Mice Epidemic', a series of spontaneous artworks created by students and a visiting plumber.

Figure 3: 'The Eye' created from sections of coloured winter stems, destroyed within 3 hours of being made. Discussions both before and after the event consider how content, siting and materials may play a part in how student work may be received.

Students are encouraged to consider how actively involving the public in experiencing their environment in new ways can allow connections and revelations to occur, they explore making 'map sticks' (MacLellan 1995) as a means of interpreting a walk for both adults and children, Figure 4. Through the opportunity of making their own 'map sticks' they consider the environment they have just experience in new and meaningful ways. Other students visit parks and gardens to consider the siting of sculpture within the landscape from both a practical and aesthetic standpoint, Figure 5.

Figure 4: Students consider the value of map sticks as a means of interpreting the environment as a record of the physical or emotional experience.

Figure 5: Visits to the Hannah Peschar Sculpture Garden, Surrey, allow students to consider the interplay between sculpture and the environment.

Introducing new ways of seeing, doing and understanding

From staff initially working with groups of students using found materials in the grounds the value of arts projects both within the curriculum and for the institution gained momentum. The College formed the Centre for the Arts and Design in the Environment (CADE) as a vehicle to allow a wider range of projects, research, consultancy and outreach to occur. Through CADE meaningful links have been made to other local, regional and national organisations involved with the arts including; Arts and Business, Arts Council East, Commissions East, Essex County Council, Gunpowder Park, Landscape and Arts Network, Leverhulme Trust, and Wysing Arts,

and these have provided advisors, funders and collaborators for more adventurous undertakings, Figure 6. In 2000 the Year of the Artists provided an opportunity for an artistic residency based at the College, and since then residencies ranging from a couple of days to a year have occurred. These projects have resulted in meaningful experiences for both the artists and the institution.

Figure 6: Students presenting ideas generated through a collaborative visit to Gunpowder Park, Lea Valley, Essex.

'Soil as a Sculptural Medium,' Jim Buchanan, land artist, 2000-1

Jim Buchanan, land artist, selected soil as the medium he wished to explore since he felt this had a resonance with a wide range of courses undertaken at the College. Through his previous work on labyrinths Jim explored with the students notions of space, movement and spirituality in the making of landscapes. Over six weeks Jim worked both in the classroom and in the wider landscape to experiment, explore and further his own work while involving students and staff in the process of discovering soil as a sculptural medium, Figures 7 and 8.

Figure 7: Land artist Jim Buchanan introduces innovative teaching techniques within the classroom.

Figure 8: Design students working together to mark out labyrinth under the guidance of Jim Buchanan.

'The Work of Memory,', Marie-Claude Quignon, community artist, 2003

The French artist, Marie Claude Quignon was inspired by a small piece of graffiti which she saw inscribed onto the white painted surface of a glasshouse, and treated this as her canvas to explore the College as a community. The artist and a member of the academic staff developed a questionnaire to generate words which would express a collective consciousness of College life. Respondents were asked to share with the artist the following: their given name, the town of their birth and to spontaneously select five words that expressed their experience of Writtle College. The words were complied by Marie Claude and with the help of students and staff inscribed on to the outside of the glasshouse, Figure 9.

Figure 9: Inscribing 'memories' of Writtle College onto the glasshouse, artist Marie Claude Quignon.

The finale of the work was an evening event when the glasshouse was lit from within with an intense blue light causing the words to glow. Over 12% of the Writtle community were involved in the project, and each day over 700 people associated with the College viewed the artwork due to the central location.

'Each Day Matters,' Valerie Thuillier, artist, 2004

Using the campus to display the artwork created by the artist and students Vallerie Thuillier continued her on-going exploration of the words: waiting, tension, traction, resistance, escape and emptiness, Figure 10.

Figure 10: Artist Valerie Thuillier with an artwork created in the grounds of Writtle College exploring the concept of resistance.

'Unappreciated Spaces,' Mark Winwood, photographer, 2003

Students explored the value and role of previously unappreciated spaces with the assistance of Mark Winwood, a professional horticultural photographer. Students were issued with disposable cameras to record their impressions of previously overlooked spaces.

Figure 11: 'The View from a Litter Bin' taken by a student exploring unappreciated spaces.

'Interpreting a Place and a Community,' Henri-George Vidal, sculptor, 2005

The sculptor Henri-George Vidal worked with students studying countryside skills and interpretation to explore new ways of experiencing and interpreting the College landscape. The artist and students produced sculptures from natural materials found on the site including clay subsoil, and timber resulting from local woodland management, Figure 12.

Figure 12: Henri-George Vidal, sculptor, next to the kiln he built on the Writtle College campus to fire student artwork made from local clay.

'The Landscape of Mosaic,' Anne Schwegmann-Fielding, mosaic artist, 2005-6

Landscape management lecture, Andy Boorman, worked Mosaic artist Anne-Schwegmann-Fielding to investigate the processes they both used in their work, and to carryout a range of community projects and explorations in landscape plantings, Figure13.

Figure 13: The Mosaic Meadow created at Writtle College by Anne-Schwegmann-Fielding and Andy Boorman, assisted by a range of students and staff.

The value of arts projects to the students and institution

Artists who join the College are encouraged to engage with the students and other members of the community in order to encourage them to see the world in new ways, to help attune students with a greater sensitivity to their environment, to promote creative and questioning minds. The benefits of these collaborations frequently go beyond the original aims of a project and have resulted in an increased confidence concerning the introduction of artists and art into a traditionally science based institution. There are challenges with such initiatives including the provision of resources, finding time within the taught curriculum, the courage to undertake new ways of teaching and learning, and the range of reactions encountered. However, with consideration, planning and management many of these obstacles can be overcome leaving the participants and viewers with the freedom to formulate their own responses to the work they have created or viewed. The positive outcomes resulting from such opportunities considerably outweigh the challenges encountered, Figure 14.

Figure 14: 'Labyrinth in a Barn' created by design students and the land artist Jim Buchanan, which formed the focal point of an evening for the whole College community.

For the students arts projects provide the unexpected within their studies allowing them to explore the view points of others and the opportunity to consider aesthetic, cultural and social issues. The projects foster in all those involved elements of creativity, innovation, imagination, the expression of ideas by diverse methods, elements of risk taking and frequently mutual support. All of these elements are vital allowing students to adapt to change, with the ability to find in the ordinary the extraordinary and to make connections through different means of experiencing their professional studies.

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Biography

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Engaging people in Biodiversity conservation, education and sustainability for a better future

Malta Qwathekana

South African National Biodiversity Institute

Introduction

Development on a fragile environment is a vain attempt to improve people's lives. Poverty and unemployment that are dominating in most underdeveloped sections of the world have resulted in people putting emphasis on maximising short-term gains through the use of exploitative practices, (Fuggle and Rabie, 1992). These exploitative practices not only place the present generation at risk but generally undermine the human existence considering the fact that the earth and its natural resources are finite. Biodiversity is threatened and endangered to a point of extinction and the key causes are human activities. Environmental threats and challenges such as the global climate change as initiated by human activities, the spread of alien and invasive alien vegetation as orchestrated by human activities; soil degradation as made possible by human activities; pollution of rivers, air and soil all made possible by human activities and many others can only be minimized to a point of eradicated through environmental awareness and education.

Changing the mindsets to shifting the emphasis to development approaches that would lead to sustainable productivity over the long term has proven to be failing because of the following:

1. As much as people understand the environmental threats that are cause by their exploitative development practices, they are in most case, due to the high rate of unemployment and hence poverty, left with few or no option but to exploit the environment in order to survive.
2. There is in most cases lack of access to information, especially by rural people, about these threats and how they can be combated because of the language the information pamphlets are written with, high level of illiteracy, location of rural communities - with officials interested in working with communities that are easily accessible,
3. Their participation in conservation has been minimized by scientific knowledge outweighing indigenous knowledge and hence they feel left out and the conservation and protection of the environment displayed as something that can only be done by outsiders who are highly educated with special expertise.
4. Food security is the key concern and the rest is secondary
5. For institutions such as schools, the management is faced with many other challenges and they end up having priorities of which things such as uncontrolled veld fires, land degradation, waste management, alien vegetation infestation, devegetation and other environmental problems become minor and of least concern
6. Environmental problems threatening schools are also inherited from the neighbouring communities and the lack of good relationship between the schools and their neighbouring communities result in such threats recurring

Sustainable development needs a stable environment and hence communities need to be educated and made aware of key and basic environmental management principles through environmental education. With all the challenges as mentioned above, holistic approaches that are designed to address all the issues and concerns surrounding the conservation of biological diversity need to be developed and implemented.

What can be regarded as a holistic approach to environmental education?

It is important to note the following:

- Communities have been educated on incorporating environmental concerns into their development objectives. In theory they know but in practice that is seldom done.
- Communities have been informed about the advantage of planting indigenous plants as opposed to alien and invasive alien trees and plants. They still believe in their alien and invasive alien ornamental plants
- Communities have been educated on the consequences of deforestation, the benefits of sustainable forest product harvesting, the whole concept of sustainable utilisation of the natural resources such as grass, fire wood, plants of medicinal value, marine resources, etc. The excuse is always the lack of alternative survival means and hence people carry on engaging in exploitative harvesting practices.
- Educators are required to incorporate environmental education into the school curriculum. This is either seen as an added responsibility or the excuse will be that most educators do not have a background in Environmental Education. They are taken by the Department of Education for in-service training which is seldom implemented in the classroom situation.
- Learners are told not to pollute the school grounds with papers but given a chance they throw the papers all over the place.
- Sustainable farming practices are spoken about by the agricultural extension officers but the "Tragedy of the commons" (Hardin 1968, cited in Juma and Ojwang, 1996) is still the norm in communal grazing land.
- If uncontrolled veld fire burns someone's house then the perpetrator can be easily traced but when it burns a school the perpetrator can seldom be detected. No one takes ownership of the school.
- Environmental education and awareness result in target audiences temporarily changing their attitudes but quickly getting back to their exploitative approaches.

A holistic approach to environmental education

This will be an approach that should ensure that while the biological diversity is conserved and the environment protected, human needs are met. The following proposals can be put forward:

- Ensure that alternative survival strategies are in place,
- Ensure that there is access to information to all,
- Language problem in writing articles and pamphlets is considered,
- The sustainability of the environmental education programmes is enhanced,
- Maximum involvement of people in the conservation of natural resources in their neighbourhood is strengthened through training and capacity building, drawing of co-management agreements for the interactive and participatory approach in the management of natural resources between the states, other institutions and communities.
- Sustainability of programmes
- Incorporation of indigenous knowledge systems into the environmental education programmes to suite target audiences
- Intersectoral collaboration, partnership building and stakeholder involvement
- Monitoring and evaluation

This requires creativity in designing environmental education programmes, dedication to work by environmental educators, fundraising, and very strong partnership building or else the efforts will be in vain.

Greening the Nation: (A case study of how the Environmental Education Unit of SANBI attempted to achieve the unachievable)

The following case study is a demonstration of an intergrated holistic approach to environmental education and awareness that look at various issues of concern and ensures maximum participation of targeted audiences in the conservation of biodiversity to enhance sustainability.

Purpose of the programme

1. To green school and community projects with the intention of creating a healthy environment
2. To create job opportunities
3. To create indigenous gardens that can be used as an outdoor teaching/learning resource
4. To introduce species that are either endangered, threatened with extinction or extinct in the areas where the project is being implemented
5. To train and build capacity in the field of environmental education, biodiversity conservation and sustainable development representatives from
    - Municipalities targeting key leaders to ensure the sustainability of the project activities,
    - Department of education to ensure the ongoing incorporation of environmental education into the school curriculum,
    - Community members employed to work in the greening projects to ensure that they are equipped with all the necessary skills for the replication of the awareness campaign by locals long after the end of the project.
    - Student interns selected from previously disadvantaged communities throughout South Africa to create a pool of locals in each area that can
6. Strengthening the partnership between schools and neighbouring communities through joint school and community projects. Whilst involved in the implementation of these projects these beneficiaries receive environmental education.
7. Fulfilling other development needs of the schools and communities involved in the greening initiatives through other development partners
8. Developing and strengthening clusters where educators share experience and are capacitated on how to incorporate environmental education into the learning areas.
9. To involve the people in the management, conservation and protection of natural resources in their respective areas

Example of one of the thirty one schools greened and involved in the programme in the district of Bizana – Eastern Cape, South Africa

Background: The school, like all the other thirty one schools, was not fenced, with no reliable source of water, was highly infested with alien vegetation such as bugweed, Indian laurel, inkberry, and many others. The school yard was very dirty and with bare patches. There are learners from children headed households, and from very poor unemployed families and these

come to school with empty stomachs most of the times. There was no interaction between the school and the surrounding community. It was common nature for uncontrolled veld fires to run from neighbouring communities to the school. It was common nature for livestock to get into the school yard and hence overgrazing and the bare patches.

Picture of the school before:

SANBI's intervention: A negotiation with the Department of Environmental Affairs and Tourism for funds to implement the Greening activities throughout the country was entered into. Through the Poverty Relief Fund a Greening initiative was initiated. The context in which the programme was designed was such that jobs for the communities neighbouring the project sites were created and environmental awareness campaigns were conducted for such communities. A huge sense of ownership for the schools as a source of employment for the communities located around the schools was created. Community-school projects such as educational nurseries to support the greening initiative were developed. School-community fruit and vegetable gardens were developed and these together with the nurseries were used for strengthening the food security component of the programme where neighbouring communities buy fruit and vegetables at affordable prices. The project partnership is such that neighbouring communities volunteer to dedicate their time to operate a soup kitchen to feed learners using resources from the vegetable garden. The school sell the rest to raise funds for the school's other financial needs.

School after being greened:

School indigenous greening: The school was generally made live, beautiful, green and clean by clearing alien vegetation, mowing and planting indigenous plants. The plant selection is done in consultation with the neighbouring communities to allow for indigenous knowledge where a significant selection of trees and plants endemic to the area either because they are extinct, endangered or threatened with extinction is made. This revives both the young and elderly people's pride and sense of ownership about the school. The education and awareness they get is such that what they practise in the work place (school environment where they are contracted to work) is practised in their homes surrounding the school. The involvement of the local chiefs, headmen and ward councillors in selecting workers and in the training provided is such that the whole community becomes actively involved in ensuring that they remove alien vegetation in their neighbourhood, they get involved in planting vegetable gardens using organic means, they start compost heaps at their homesteads using biodegradable waste and hence minimising waste, etc, they recycle by using some solid waste such as bottles in designing their gardens, etc. Stones found in the schools and neighbourhood and tree stumps from alien trees removed are used to create rockeries and garden designs.

Lack of fencing and reliable sources of water: other partners are drawn in to do what the unit cannot afford doing. For example development agents such as Eskom Foundation, municipalities both local and district as well as the department of Education are consulted to get their commitment to the project. Some offer to contribute fencing and some offer to contribute bore holes and/or water tanks to collect storm water for irrigation, etc.

Maintenance and sustainability of the project: allocation of land for school/community nursery, fruit and vegetable gardens guarantees the community's commitment in watering and weeding both indigenous and fruit and vegetable gardens in schools. Community indigenous, fruit and vegetables and medicinal plant nurseries guaranteed affordable production points for schools and community projects. Co-management agreements are entered into with schools and communities

to ensure successful running of the school/community projects as well as adherence to environmental principle in doing such. Schools involved in the programme are also linked with other programmes running in the country such as the eco-school programme, the Gardens of Pride competition, 4H Agricultural Programme run by the Department of Agriculture on school gardening and many more. The programme has a monitoring and evaluation component that follows up on every aspect of the programme to ensure sustainability and continuity.

Education for sustainability: Educators and greening teams selected in schools and communities are taken through Horticultural workshops on the garden development and maintenance and further taken through intensive teacher professional development workshops on how to use the garden as an outdoor education resource to enforce environmental learning in the school curriculum. This is done in consultation with the existing education policies to ensure what is done with learners and educators is in line with the Department of Education's expectations and assists them in implementing their policies that require incorporation of environmental education into the school curriculum. For further information on this, the SANBI Environmental Education team is going to take the delegates through examples of these workshops in a workshop prepared for this conference.

Generally the programme is very complex in nature as it is intended and designed to address various aspects that are an excuse for most failures in biodiversity conservation, environmental education and sustainability. However, in the end of the day the benefits are immeasurable and invaluable considering the fact that one ends up with environmentally educated schools and communities that are capacitated to give support to their neighbours and hence spreading and replicating the effects. One end up with a group of schools that are committed to the incorporation of environmental education into the school curriculum. One ends up with very beautiful, fenced, clean and fresh looking schools. Principals have the following comments about their greened schools:

1. The teaching/learning environment has completely changed
2. The relationship with the neighbouring community has changed tremendously
3. Vandalism of the school property has stopped
4. The teaching and learning attitudes have improved remarkably
5. Learners are more well nourished during lunch breaks than ever before with vegetable soups and can't wait for fruits to be available once fruit trees produce ripe fruits
6. The sense of ownership and pride by community members, school management teams, educators and learners is has increased resulting in the improvement in behaviour.
7. Stakeholders have been made aware of their roles and responsibilities and hence that has eased the stress from the school management teams

Conclusion

For all these success stories there needs to be a lot of effort put in designing such programmes, a lot of consultation, a lot of resources and hence a lot of fundraising but considering the results it is worthy. Getting out of the comfort zones and going outside there to exploit available resources to embark on holistic and integrated approaches in environmental education is a challenge on its own. Thinking of the scope of work, resources required and the schools and community projects to be reached out there is quite depressing. The recommendation is to think globally but act locally (WWF-SA, 1991). The little that can be thoroughly done means a lot to the environment.

The recognition of initiatives such as the outreach greening the Environmental Education of SANBI and many other institutions are engaged in, their contribution to the climate change issues

by planting considerable amounts of indigenous trees, shrubs and ground covers and hence reduction of carbon dioxide in the atmosphere, their contribution in land rehabilitation and combating of soil erosion, the awareness created through experiential learning, training and capacity building and many other efforts, is very minimal. This has resulted in funding agencies and many other institutions that have a potential to fund such initiatives not showing commitment and support and hence a tremendous financial stress to such initiatives.

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On the way to sustainable development: What can we do?

Dr. Elena Pushai, Maria Shuvalova & Dr. Yuri Naumtsev

Tver State University Botanical Garden, Russia

Introduction

Many people living in urban surroundings are out of touch with natural world. It is the reason of many social and environmental problems. Botanic Gardens, located mostly in towns, could contribute to the solution of these problems. Social roles and functions of botanical gardens have drastically expanded over last few decades. Having an extensive scientific and historical potential and traditions, they become an educational centers, which demonstrates modern achievements and know-how in science and different sustainable development issues. What exactly Botanic Garden can do on the way of sustainable development?

The Garden

Botanic Garden of Tver State University founded in 1879 is a living museum under open air. The Garden is located in historical part of the city of Tver and covers relatively small territory of 2,5 hectares. Collections of the Garden consist of 350 species of trees and shrubs and more than 2500 herbaceous plant species. The plants are arranged according to their geographical zones: the Far East, Europe, North America and Siberia. There are 8 expositions and 6 conservation collections.

The Mission of the Garden is to open to the visitors the diversity of the plants world in order to contribute to harmonious and sustainable interaction between people and nature. Environmental education which is meant to facilitate biodiversity conservation in the region and public awareness of sustainable development issues is defined as one of the key functions of the Garden.

Garden applying different instruments of the audience engagement: concerts, festivals, poetry evenings, art exhibitions and master classes, interactive games, competitions, family ceremonies etc. As the matter of fact most of adults coming to the garden just because of their children, although teenagers and informal youth are coming exceptionally for concerts etc. Nevertheless according to the garden's questionnaires coming once most of them are returning back and becoming garden frequenters.

Information space in the Garden adopted for visitors with different age and social background. Garden turned to use new interpretative tools. Ethno-botanical information successfully applied in educational projects. A series of plant interpretation signs and movable stands established in the Garden, contain exciting stories and legends about plants and information about old local traditions of plant use.

Every season the Garden is visited by more than 12 000 people. The Garden offers for it's visitors a variety of educational activities contributing to spreading the ideas of sustainable development such as guided tours, interactive games and classes, interpretative techniques and cultural activities. The influence of the Garden is not limited to its visitors only. Garden developing its own public relations policy. Thanks to the permanent close collaboration with the local mass

media (5 TV channels, radio, newspapers, information portals, websites) the audience of the Garden's public awareness programs has considerably grown beyond the boundaries of the Garden. All above mentioned factors provides to the Garden wide opportunities for public awareness on different aspects of sustainable development issues.

Projects on sustainable development carried out by Botanic Garden of Tver State University

Since 1997 Botanic Garden of Tver State University became a member of Botanic Garden Conservation International (BGCI). The membership in BGCI initiates the participation of the Garden in a number of international projects. In 1999 project "Biodiversity Conservation Strategy for the Tver Region" financed by BGCI started. At present not only scientific, but also socially-oriented projects aimed to contribute to sustainable development of the Tver region are in the focus of the Garden activity. We consider three recent projects in this field which from our point of view are showing how the Garden can contribute to the process of sustainable development.

In 2002-2004 Garden in collaboration with NGO Tver Ecological Club successfully fulfilled pilot project **"Environmental Education for the Citizens of Tver"** in the frames of joint Dutch-Russian Project "Local Agenda 21 for Russia" funded by Milieukontakt Oost Europa (The Neterlands). The main goal of the project was to improve the quality of the town dwellers life by saving and development of the green zones of the city of Tver. In this project Garden was chosen as a model of sustainable territory in urban surroundings. Great attention was paid to the process of establishing of informational space of the Garden. Interpretative displays and tables appeared in the garden expositions. Members of the garden staff consulted town dwellers on the questions of greening of the backyards near their block of flats in town districts. Garden took an active part in publication of the document "Strategy of Preserving and Development of the Green Zones of the city of Tver for improving the quality of town dwellers life" and colorful leaflet "Green Zones of the City of Tver". As the result of this project Garden demonstrated its scientific and social capacities for local authorities and population of the Tver Region and gained a new partners, volunteers and friends. Attraction of people's attention to the problems of rational use of natural resources, town environment, biodiversity conservation and popularization of sustainable development issues and practical collaboration with initiative groups of town dwellers in the field of creation and development of green zones are considered as the most important results of the project.

During the year of 2005 Garden carried out project **"Open Your Heart to Nature": Raising Public Awareness of and Support for Biodiversity Conservation in the Region"** supported by BGCI and financed by HSBC in the frames of "Investing in Nature" Program. The main goal of the project was the capacity building for strengthening the role of Tver Botanic Garden in the research, conservation and public awareness on the problems of biodiversity as a vital component of sustainable development. The project was called to attract attention of different age and social groups to the reduction of biodiversity in the Upper Volga region and the importance of its conservation for sustainable development (in accordance with paragraphs 2.10, 2.18.3, 2.19.2 of the International Agenda for Botanic Gardens in Conservation). The outcome of the project was seen as the development of new effective techniques of raising public awareness of biodiversity conservation and sustainable development issues among the groups of different age and social status. Among the wide range of the project activities the following should be noticed.

In summer 2005 field research expeditions routing across rural districts of Tver Province was organized. During the expedition multidimensional floristic explorations were made, populations

of rare and endangered species were monitored, meetings with local biology teachers and pupils were or organized to spread the ideas of sustainable development. As the result garden collection "Living Red Data Book of Tver Region" was noticeably enriched.

In the frames of the project a set of 10 bookmarks "Rare and Endangered Plants of Tver Province" have been published. Colorful two-side bookmarks were meant to aware people of 10 rare and endangered plants of Tver Province. Among them *Helichrysum arenarium L. Moench, Polipodium vulgare L., Iris Sibirica L., Pulsatilla patens L., Orchis militaris L., Equisetuem variegatum Schlech. ex. Web. et Mohr., Hepatica nobilis Mill., Nymphaea alba L., Gladiolus imbricatus L, Cypripedium calceolus L.* The format of bookmarks was considered as the most effective for distributing information on rare and endangered plants in comparison with other publishing formats. The bookmarks are used widely by different people and everyone can see information quite often. It is made people to remember plant visuals better. On the front side of the bookmark there are both a photo and a botanic illustration of the plant, and Latin, Russian and local name of the specie. On the backside there is information about habitat and short curious stories about origins of plant names. Bookmarks were distributed free of charge at schools of Tver Region and given to the Garden visitors.

In the very beginning of 2006 Botanic Garden of Tver State University in collaboration with NGO "Tver Ecological Club" has started and now carrying out a project **"Back to the Roots: Sustainable Land-Use and Ethnobotanical Traditions".** The project was supported by British Council and financing by Department for Environment, Food and Rural Affairs (DEFRA) in the frames of Small Environmental Projects Scheme SEPS-3. The main goals of the project are as following raise the public and local authorities' awareness about the principles of sustainable development and the possibilities and necessity of its practical implementation in everyday life; increase the level of ecological culture of general public and decision-makers; revive etnobotanical traditions of the Tver region and traditions of wise land-use. Some of the planned project activities are already realized.

Training workshop "Education for sustainable development" for working group of teachers and education specialists from Tver Local Museum and Regional Station of Young Naturalists, have been organized. The workshop included lectures, training interactive games, dissemination and explanation of printed materials and guidelines. Participants were informed about UN's "Decades of the Sustainable Development Education 2005-2014" and got acquainted with Internet resources on Education for sustainable development.

Open-air workshop "Garden as It Seen by Artists: Let's Draw Plants Together" has been performed in the Garden. Team of teachers and students of Tver Art College named after Venetsianov, gave master class on botanical art and illustration for garden visitors.

One-week ecological camp for children "Seven Days for Sustainable Development" for target group of schoolchildren has been organized. Team of teachers, which gave classes for children, consisted of specialists in botany, biology, ecology, history, zoology. The work in ecological camp was organized in accordance with ecosystem approach. Every day children got acquainted with different components of biodiversity on the territory of the Garden. They explored plants, birds, invertebrates, water and soils. They discussed the results of man's influence on nature, the possibilities of rational use of recourses and other questions of sustainable development. All classes took place in open-air, uninterruptedly during seven days. It gives participants the opportunity to be "plunged" in educational process. Different types of activities master classes, workshops, lectures, guided tours, interactive games, discussions, tea parties with teachers made ecological camp interesting and fascinating for children.

International Agenda for Botanic Gardens in Conservation highlighted the fact that Botanical Gardens should demonstrate the practice of sustainable development on their own. Realizing that idea, Garden had converted it's minivan from petrol into more environmentally friendly gas fuel.

Besides above-mentioned activities in the frames of this project a series of ethonobotanical expositions demonstrating principles of sustainable land use has been created. Among them "Compost: Step-by-Step", "Travnik or Wild Kitchen Garden" and "Garden of Native Plants". All expositions have interpretative tables and posters advising visitors how to make the same sustainable models in their gardens and yards.

Fieldtrips around Tver region for ethnobotanical research, collecting photo and video materials about local traditions of sustainable land use using methods of historical landscape studies, collection of plant material for the enrichment of the expositions "Back to the roots" has been undertaken. Representatives of local population were informed about the project and basic issues of sustainable development.

Conclusions

During last decade Garden has undertaken great efforts for popularization of ideas of sustainable development in Tver Region by realizing projects, and serving as a model of sustainable territory in urban surroundings. All activities of the Garden in the field of environmental and sustainable development education are in strong continuity with each other. We believe that due to the Garden's activities and projects local authorities and population of the region are coming to most mutual understanding of the necessity of sustainable use of natural and plant resources of the Tver Region. Botanical Garden can be used as a model, which demonstrates principles of the sustainable development in the urban environment, playing the role of the regional center for sustainable education.

Gardens for Life – Eden Project

Tony Potterton

Eden Project, United Kingdom

Over the past three years the Gardens for Life pilot project has been exploring ways of promoting education for sustainable development and global citizenship. The strategy adopted combines garden-based learning with both local and international school partnerships.

The idea of using school gardens is well-established as a useful way of engaging children and supporting the teaching of curriculum subjects. Gardens for Life has provided additional proof that the growing of food crops is a valuable educational activity that can be interpreted and adopted in different global contexts. It has also shown that gardens are a useful basis for promoting experiential learning that leads to the development of reasoned positions on important issues and a predisposition to act on them.

The project has involved a number of different institutions in UK and abroad. A steering group has provided for the collaboration, while partners "in the field" have mobilised and supported schools to take part. 74 schools in UK (34), India (20) and Kenya (20) have been involved since early 2004. We can make some generalisations (whilst remembering that they are just that) about the way school gardening has been taken up in the different countries.

Many of the UK GfL schools have undertaken garden development as part of overall planning for outdoor learning and school grounds development. They have involved the students in this process, in everything from doing environmental audits to organising garden festivals for parents and the community. They have often also succeeded in incorporating artwork within the garden setting.

Our Indian schools have been located in the big cities of Mumbai and Pune. Many are very large and have very little space for garden development. Nevertheless they energetically took up the challenge of providing their students with the experience of growing plants, as they were quick to see its educational value. In addition to using gardens as outdoor science laboratories and art rooms, their work brought out cultural and spiritual values around various foods and medicinal plants.

The Kenyan schools responded to the idea in a context of achieving food security by preparing the large areas of land around the schools, which most of them have, and planting them up with important food crops. This was seen as a way of improving school attendance and the health of students. Within a short time many were providing for their kitchens and some had surpluses for sale. In addition there were examples of exceptional community involvement in the project, as school and local knowledge were connected through the garden.

Although a more recent trend, school partnerships and linking are also now well established at least in UK. The government has promoted the strategy as a means for implementing education on sustainable development and cross-cultural understanding. Gardens for Life has also explored what a partnership may mean to schools in countries in the "south".

Rather than linking schools "one-to-one" the project has pioneered the idea of global groups. Through these, schools have been connected across the three continents.

Preliminary "introductions" were made by schools exchanging profiles of their gardens. Three exchanges of materials have been made when examples of the work of students have been sent between the schools in each group. These have proved to be valuable classroom materials for teachers, giving children a very direct insight into the lives of others in different circumstances. Teachers have reported that the experience of touching real material from their counterparts across the world has high impact on young people.

In addition there has been preliminary work to develop an electronic communications site through which the schools can communicate. Many of the rural Kenyan schools do not have electricity or telephones but the project has managed to get computers for some of them and they have been able to use CDs of project and exchange material. The introduction of computers has generated much interest in schools and local communities.

Gardens for Life has also been concerned to develop learning resources. This has been done by involving the many teachers who have been responsible for successfully implementing the project.

Materials to link gardening with classroom curriculum teaching incorporating the global dimension have been developed and made available in collaboration with the Association for Science Education on the **Science Across the World** Website, where they are available for any school to use.

Schools have been encouraged to use the project as means of making contact with, and understanding local community issues, especially relating to food production and consumption. In many cases it has been possible to secure community participation in the gardening activities and forge links between the school and its social environment. Local knowledge and "classroom knowledge" can be brought together

Clearly the Gardens for Life project has addressed many priority agenda for education today. Some of these concern the learning of individual children, others support effective teaching. Some relate to important content areas for future global citizens, while others may promote healthier lifestyles.

The schools involved in the pilot project have proved that the combination of gardening and partnership can yield valuable educational experience for children and effective teaching tools for teachers, while strengthening schools. They have shown that this can be achieved across the world. This is an initiative in which a balance can be struck between the commonality of human beings and their needs, wherever they are, and the diversity of human response which we value.

References

www. edenproj ect. com

Biography

Tony Potterton has worked for 30 years in education, social development and community-based natural resource management in UK and overseas.

What children talk about with their parents when visiting the Eden Project

Dr. Alan Peacock

University of Exeter

Introduction and research design

During the interviews that were part of our earlier evaluations of children's learning during teacher-led school visits to the Eden Project (Bowker 2004, Peacock & Bowker 2001, Peacock 2002), many children voluntarily expressed a preference for visits with their parents rather than with their school. Various reasons were given for this, indicating that children tended to think that they learned more with parents and had more control over agendas and discourse during the visit. Research carried out elsewhere in similar contexts (e.g. Ellenbogen, 2002; Griffin and Symington,1997; Rennie et al., 2003; Rahm 2004) also suggests that children's learning is enhanced by a shift from task-oriented to learning-oriented strategies.

The social constructivist notion that talk promotes learning has been a basic principle of education, and particularly primary schooling, for at least 40 years, and has shaped even such things as the way children are organised in groups in classrooms. The research of Vygotsky, Bruner, Driver and others is so familiar, and has been well reviewed by such authors as Steffe and Gale (1995) that it does not seem necessary to take up space with a summary here. There is also a considerable amount of research literature on families and learning, such as the work of Tizard and Hughes, exploring the role that parents can and do play in fostering children's learning through play and talk (Tizard and Hughes 1988, Hughes 1994). More recently, critiques of these approaches from a socio-cultural perspective (e.g. Cobern, 1998, Roth 2003) have suggested that the social perspective varies from context to context, so that cultural or community values have also to be taken account of.

Hence in collaboration with Visitor Research staff at Eden, we planned this study of children visiting Eden with their families. Our intention was to find out how children's experiences during family visits differed from those during school visits, and to make an assessment of what and how children learned in the family context. To do this, we planned a two-part study. One part involved identifying children's ideas about 'Plants and People' using Personal Meaning Mapping (PMM: Falk & Dierking 2000) at the beginning and end of their visit: this will be reported elsewhere. During the rest of the visit, we recorded family discourse using minidisk recorders and lapel microphones, set to pick up conversation within a 5 metre radius, so that virtually all of the talk between children and parents was recorded. The length of visits varied between 1.2 to 4.5 hours, the mean length being 2.5 hours. Families were asked not to switch the recorder off at all during the visit, so that all conversations, including those during lunchtimes, were recorded. No directions were given to families about what to do or where to go during their time at Eden.

The recordings were transferred from minidisk to CD, and have so far been analysed in several ways. The first level analysis focused on where and how families chose to spend their time, in terms of the biomes, exhibitions, lunches and drinks, the shop, travelling on the land train etc. At the second level, analysis focused on what kind of talk children and/or parents were engaged in, through completing check lists at 10-second intervals. A third level analysis then focused on the concepts being mentioned or discussed, using the same list of concept categories identified through the PMM study. An inter-rater agreement was carried out on one

recording, providing agreement of around 80% on both the above analyses. These analyses are reported in this paper.

The next stage of analysis will consider the concept discussions in relation to the PMM evidence, to determine what this tells us about the link between family talk and the concepts 'learned' by children as indicated by the PMM study. A further analysis will be based on close discourse analysis of four representative cases from within the 13 families studied, involving detailed study of the recordings followed by interviews with the families.

Sampling

We initially approached all primary schools within a 25-mile radius of The Eden Project, to ask if they would be willing to circulate an invitation letter to parents. Almost all agreed, and as a consequence about 2,000 letters were circulated. The invitation offered free family entry to those participating, hence the response was good, allowing us to choose a sample of 15 families that were suitably representative in terms of gender, child's age, family size and number of previous visits, from around 60 volunteers. Of the 15 families selected, complete recordings were obtained for 13 separate visits during May-June 2003. Details of the families are given in table 1 below.

Table 1: family characteristics

Family code *(B=Boy, G=Girl)*	*Parents present*	**Age of child interviewed** *and accompanying siblings*	*Previous visits to Eden*
B1	2	**11**	1 month earlier
B2	2	**9,** *6*	3 months earlier
B3	2	**8**	2 months earlier
B4	1	**6,** *3*	None
B5	2	**11,** *6,5*	None
B6	2	**10**	1 year earlier
G1	2	**9,** *7,3*	3 months earlier
G2	2	**11,** *8*	1 year earlier
G3	2	**9,** *8*	1 month earlier
G4	2	**5,** *2,2(twins)*	None
G5	2	**9,** *1*	1 year earlier
G6	2	**8**	3 months earlier
G7	1	**9**	None

Where and how did families spend their time?

Table 2 indicates how much time was spent by families on the main activities during their day. In the table, the categories used are defined as follows:

- *The Outdoor Biome(OB)* includes all planted areas of Eden that are outdoors, including such areas as 'Wild Cornwall', the tea plantation, vegetable and flower gardens, ponds, and also includes the various sculptures and artefacts placed within these areas.
- *The Humid Tropic Biome (HTB)* is the largest of the indoor biomes, comprising tropical rain forest habitats typical of West Africa, Oceania, Asia, etc.
- *The Warm Temperate Biome (WTB)* is the other covered biome, comprising habitats from the Mediterranean, California and South Africa.
- *Exhibitions and Performances* include all free-standing exhibitions around the site and in the Visitor Reception area, as well as individual performances by theatre in education companies, story-tellers, visiting speakers etc.

- *Drinks, Lunch and Toilets* covers all time spent in cafes, restaurants and other indoor or outdoor food outlets.
- *Other* time includes walking between biomes, waiting for each other, waiting for (and travelling in) the land train[1].

The table indicates that, whilst families spent very different amounts of time at Eden, the amount of time spent in the HTB (average 43 minutes) and WTB (average 30 minutes) were fairly consistent, as well as being very similar to time spent in the same location by school groups. Just under half of all the time at Eden was typically spent in these two biomes, though this tended to be greater in the cases of families who chose not to visit any exhibitions or performances. Most families also tended to visit the HTB first in the morning, going into the WTB later, often after a comfort break.

Time spent in other locations was much more variable. The minority of families that spent time watching performances had made several previous visits. Time spent in cafes and restaurants varied from 0-69 minutes, and did not seem to be related to family characteristics or to the weather.

Table 2: time spent in different locations during visits

Family code (B= boy, G = girl) *no. of previous visits*	**Total time recorded (to nearest minute)**	**Outdoor biome Time/%**	**In Humid Tropic Biome (HTB)**	**In Warm Temp. Biome (WTB)**	**Exhib's /perf's**	**Drinks, lunch, toilets**	**Other, e.g moving, waiting etc.**
B1	130	7 *5*	52 *40*	53 *41*	0	0*	18* *14*
B2	182	21 *12*	56 *31*	36 *20*	0	29 *16*	40 *22*
B3	157	11 *7*	48 *31*	25 *16*	28 *18*	38 *24*	7 *4*
B4	86	9 *10*	50 *58*	22 *26*	0	0	5 *6*
B5	27 1	33 *12*	0	42 *15*	129 *48*	45 *17*	22 *8*
B6	17 6	39 *22*	53 *30*	46 *26*	0	33 *19*	5 *3*
G1	19 2	11 *6*	36 *19*	22 *11*	43 *22*	69 *36*	11 *6*
G2	145	37 *26*	41 *28*	28 *19*	7 *5*	28 *19*	3 *2*
G3	7 7	13 *17*	37 *48*	23 *30*	3 *4*	0	1 *1*
G4	151	27 *18*	36 *24*	29 *19*	13 *9*	46 *30*	0
G5	104	9 *9%*	48 *46*	19 *18*	1 *1*	9 *9*	18 *17*
G6	142	28 *20*	38 *27*	30 *21*	3 *2*	4 *3*	39 *27*
G7	131	11 *8*	41 *31*	26 *20*	4 *3*	31 *24*	18 *14*
Average (rounded to nearest minute)	**151**	**19** ***13%***	**43** ***28%***	**30** ***20%***	**(17)** ***(11%)***	**29** ***19%***	**15** ***10%***

* child left family and walk ed around alone whilst parents and siblings remained in cafe

[1] A tractor-powered 'train' that carries visitors from the bottom of the site back to the Visitor Reception and shops at the entrance/exit. Walking down through the outdoor biome to the HTB/WTB at the beginning of the visit was usually categorised as 'Outdoor Biome' as families tended to comment on what they saw, whilst returning to the top after the visit was usually categorised as 'Other', since by this stage families tended to behave as if the visit had ended.

How much talk took place in different locations?

Table 3 represents the categorisation of the talk recorded, carried out by analysing discourse at 10-second intervals, for one example family. Table 4 then provides data across all families on one exemplar category (child talking about Eden-related issues).

The talk categories used in these analyses are defined as follows:

- *No talk audible.* Nothing is being said by either child or parents during this period.
- *Child talking: Eden related.* Child is talking about topics that clearly relate to the experience they are having, e.g. about the plants, structures, habitat etc. These comments may also be affective responses such as likes, dislikes, fears, frustrations caused by things experienced with the senses, or may be comments linking their experiences to domestic, school or holiday experiences.
- *Child talking: asking question.* Child raises a question related to the experience, directed towards parents.
- *Child talking: unrelated.* This category includes all talk by the child that has no apparent relevance to their experience, such as what they are going to do after their visit, what they will eat, singing, talk about food, their friends etc.
- *Parent talking: Eden related.* Parent is talking about topics that clearly relate to the experience they are having, e.g. about the plants, structures, habitat etc. These comments may also be affective responses such as likes, dislikes, fears, frustrations caused by things experienced with the senses, or may be comments linking the experiences to external experiences, as with the child.
- *Parent talking: asking question.* Parent raises a question related to the experience, directed towards child.
- *Parent talking: unrelated.* This category includes all talk by either parent that has no apparent relevance to the current experience, as indicated above for the child.
- *Both talking: unclear.* Relates to conversations, almost always unrelated to Eden, in which more than one person (child and parents) is talking simultaneously, making the content difficult to analyse.
- *Other talk: Eden staff.* This comprises any talk by Eden staff directed towards the family.

Table 3: example analysis of talk by one family

Nature of talk	***Total time (mins) and as %***	***Outdoor biome Time/%[2]***	***In HTB Time/%***	***In WTB Time/%***	***Exhibitions/ perf's Time/%***	***Drinks, lunch, toilets Time/%***	***Other, e.g moving, waiting. Time/%***
No talk audible (child or parents)	68 *43%*	3 *27%*	18 *38%*	7 *28%*	14 *50%*	23 *61%*	3 *43%*
Child talking- Eden-related	17 *11*	2 *18*	8 *17*	5 *20*	2 *7*	0	0
Child talking- Asking question	4 *3*	1 *9*	2 *4*	1 *4*	0	0	0
Child talking- Unrelated to Eden	17 *11*	3 *27*	4 *8*	1 *4*	3 *11*	5 *13*	1 *14*
Parent talking- Eden-related	24 *15*	1 *9*	12 *25*	7 *28*	2 *7*	2 *5*	0
Parent talking- Asking question	2 *1*	0	1 *2*	1 *4*	0	0	0
Parent talking- Unrelated to Eden	12 *8*	0	1 *2*	0	2 *7*	7 *18*	2 *28*
Both talking together- unclear	9 *6*	1 *9*	2 *4*	2 *8*	2 *7*	1 *3*	1 *14*
Other talking- Eden staff	0	0	0	0	3 *11*	0	0
Totals rounded to nearest minute[3]	**157**	**11** ***7%***	**48** ***31%***	**25** ***16%***	**28** ***18%***	**38** ***24%***	**7** ***4%***

Family Code: B3

In the specific case of this fairly typical family, it can be seen that the proportion of non-talk is lowest, and the proportion of relevant talk highest by both children and parents, when families are observing the three biomes. There is much less talk while moving, waiting and during comfort breaks; what talk there is during these periods is more likely to be unrelated to what the family has been doing and seeing. We expected that there might be a good deal of 'reflective talk' during their lunch and other comfort breaks about what families had seen: typically, however, much of the talk during these breaks in all families related to food and drink. The amount of time spent asking questions was small for both the child and parents; this is also typical of most families. It was also clear, however, that children's talk when with their families had the effect of setting the agenda for much of the time, in terms of where they went. This is crucially different from children's experiences during school visits, where the agenda is largely set by teachers.

The above family is fairly typical of the sample as a whole, though there are marked exceptions amongst the sample. One family engaged in much more Eden-related talk than all the others, whilst two families engaged in much less. Detailed analysis of these cases is beyond the scope of this paper: there are however some important points to be made about the differing nature of discourse between families, which will be addressed in a later section.

[2] Figures quoted in italics in columns refer to the time spent on each type of talk, as a percentage of their entire talk during their time in each location.
[3] Figures quoted in italics in this row refer to the amount of talk in each area, as a percentage of total time at Eden.

Table 4: children talking (Eden-related) across all families

	Total time (mins)	***As % of total time recorded***	***Outdoor biome Time/%[4]***	***In HTB Time/%***	***In WTB Time/%***	***Exhib's/ perf's Time/%***	***Drinks, lunch, toilets Time/%***	***Other,e.g moving etc. Time/%***
B1	15	*12*	0	6 *12*	9 *17*		0	0
B2	29	*16*	3 *14*	14 *25*	8 *22*	0	3 *10*	1 *3*
B3	17	*11*	2 *18*	8 *17*	5 *20*	2 *7*	0	0
B4	10	*12*	0	6 *12*	4 *18*	0	0	0
B5	23	*8*	4 *12*	0	12 *29*	5 *4*	1 *2*	1 *5*
B6	35	*20*	10 *26*	14 *26*	7 *15*	0	4 *12*	0
G1	20	*13*	2 *18*	4 *11*	8 *36*	*	5 *7*	1 *9*
G2	29	*20*	7 *19*	12 *29*	8 *29*	1 *14*	1 *4*	0
G3	26	*34*	4 *31*	11 *30*	9 *39*	2 *7*	0	0
G4	24	*16*	5 *19*	8 *22*	7	3 *23*	1 *2*	
G5	22	*21*	3 *33*	11 *23*	5 *26*	0	3 *33*	0
G6	25	*18*	5 *18*	10 *26*	6 *20*	0	0	4 *10*
G7	32	*25*	2 *18*	16 *39*	8 *31*	2 *50*	1 *3*	3 *17*
Average time	***24 mins. B 21.5 G 25.4***	***16% B 13.0% G 15.6%***	***3.6 B 3.2 G 4.0***	***9.2 B 8.0 G 10.2***	***7.4 B 7.5 G 7.3***	***1.2 B 1.2 G 1.1***	***1.2 B 1.3 G 1.6***	***0.8 B 0.5 G 1.1***

* microphone was switched off during this time

The nature of family talk

There are several points to note from this table. For almost all children, there is more Eden-related talk in the three biomes than elsewhere: a majority of children engaged in little or no Eden-related talk whilst in cafes, moving around or waiting. The same was true of parents. Boys in general engaged in less Eden-related talk, across most categories. However, the sample size makes statistical tests of significance inappropriate.

Many of the children engaged in reading aloud of information and signs. This was significant for two reasons, namely a) this is markedly different from our observations of children in school groups, where very few read any signs; and b) their reading aloud revealed frequent mistakes that could lead to misunderstanding (for example, their were instances of children reading 'palm tree' as 'plum tree', 'papyrus' as 'papaya', 'cocoa' as coca cola', and 'putrid' as 'pure'). In most instances, however, parents corrected their child. In school groups, by comparison, where children read silently if at all, such misconceptions may go unnoticed by teachers.

A further point to note from evidence in the appendices is that the proportion of non-talk as a percentage of total time is fairly consistent (around 35%), across different locations as well as across families, suggesting that silence is a necessary part of all discourse in such contexts as Eden. What exactly takes place during periods of silence is of course difficult to ascertain;

[4] Figures quoted in italics refer to the time spent by each child on Eden-related talk, as a percentage of their entire time in each location (from table 2).

children and parents may be making observations, reflecting on things seen, or simply switching-off for a rest from stimuli, in an environment of perceptual overload. In a heavily-populated context such as Eden, they may also be people-watching or listening to extraneous conversations. The concepts mentioned in the post-visit PMM, along with subsequent interviews, may give clues about the role of silence in learning: this will be the focus of a subsequent paper. Some specific aspects of talk are now dealt with separately.

The importance of questions and the nature of 'conversation'

Questioning has been seen as a key element of children's learning by many authors over a long period of time. In learning about science ideas, there has been a good deal of research into the nature of effective questions, summarised by Feasey (1998). However, questions played very little part in the discourse of most families at Eden, regardless of where they were located, though both children and parents tended to ask slightly more questions in the HTB than elsewhere. Rhetorical questions such as *"isn't that lovely?"* were generally categorised as statements. Some children asked virtually no Eden-related questions all day, and three sets of parents asked no such questions at all.

This begs questions about the nature of conversation: and in this study, a conversation was considered to be an interchange of words and thoughts in which one statement leads on from and extends a previous statement by another party. Using such a definition, it is clear that most of the questions that were asked were closed, factual questions and elicited only a closed response that terminated the exchange (e.g. *"what's that?" "It's a horseradish tree")* rather than leading into a conversation.

One family generated twice the frequency of questions from both child (male) and parent as any other family, and amongst other things, this may be related to the nature of their conversations. A typical exchange is quoted below, spoken whilst the family were looking at 'desert' plants in the Namaqualand section of the WTB:

Mother: *It's like desert…funny…*

Child: *You'd think it'd all be like desert, but it's got these lovely blues, oranges, yellows, a few reds…*

Father: *We think of desert as like the Sahara, but desert just means an area with less than a certain amount of rainfall…*

Mother: *Ooh, I like those reeds, those reed-looking ones!*

Child: *How come they can grow on, like, rock?*

Father: *The wind blows a bit of soil along, then a seed drops in, then…*

Mother: *Look, isn't that amazing! What is it?*

Child: *Strange, isn't it.*

Father: *Must be a reed of some sort…*

Child: L*ooks like porcupine quills!*

Mother: *I'd like one of those…*

Child: *Do you think animals eat these plants?*

Mother: *They should have lizards in here!*

Child: *They do. How do they get all their names?*

Father: *I don't know. (Looking at another plant): Is that the same kind but bigger, do you think?*

This extract follows a pattern typical of many of this family's conversational exchanges:

- Mother draws attention to something she has observed with an affective observation *('look Jo, look at the colour, isn't it freaky!')*
- Child responds by asking a question about the object of attention *('what does Breadfruit taste like? Isn't it doughy?)*
- Father responds, often in an open ended way *(I'm not sure… they're seedless fruits, they cook them like potato, but call them Breadfruit for some reason… maybe it's a staple diet, because they're easy to grow. You don't have to mess about getting the poison out, not like Cassava…)*
- Child or mother extends discussion with a follow-up comment or question *(what's a cassava?)*

It is tempting to conclude that this kind of conversational interaction, which was commonly observed in this family but rarely in most of the others, is likely to lead to more learning, but we are not able to draw any such conclusions until comparisons of discourse styles with changes in children's conceptual understanding have been made. However, Rahm's (2004) review of related research indicates that the mediational role of parents is crucial; and in our earlier observations of school groups, we noticed that teachers frequently initiated such conversations, whilst other accompanying adults (e.g. parents, classroom assistants) rarely did. Yet even for teachers it was more difficult to sustain such conversations with individual children, whilst working with and managing a group of (usually) 5-6 children. This may be one of the reasons why children prefer visiting with their families.

The recordings also indicate that mothers talk more than fathers when both parents are present, and that their contributions are often qualitatively different, as in the above examples. When one parent separates from the family group (e.g. to take a younger sibling to the toilet), the nature of discourse can change dramatically, often generating an increase in Eden-related talk by the child.

Unrelated talk

During their entire visit, children talked about unrelated things for on average 13% of the time and parents for 7%, compared with 16% and 12% for their Eden-related talk. Some of this child talk involved such things as making demands *('I want to go for a drink')*, discussing events or people outside of Eden *(tonight, are we going to…?')* or frequently, singing to themselves. It was not uncommon for children to be concerned about locations, exits, entrances and other things indicating that they were unsure about where they were or whether they were going in the right direction. This kind of talk took place in all locations, though there was less of it when watching performances, inevitably, and proportionately less in the WTB, perhaps because exits are visible, there is less background noise, and consequently more freedom to move and stop at will, to discuss what is seen.

Conceptual talk during Eden-related talk (ERT)

The concept categories used were directly derived from those used by the same children in their Personal Meaning Maps made at the beginning and end of their recorded visit: these break down into four main conceptual areas, namely

- Ideas relating to plants themselves and their use by people, such as plant products, trade, our dependence on plants and the significance of wild and domesticated plants (categories 1-5)
- Ideas about the context in which our understanding of the above develops, including the global, historical, geographic, time, home and school contexts (categories 6-9, 13, 16)
- The scientific processes relating to plant growth, such as photosynthesis, respiration, life cycles, habitats, ecology, food webs, conservation, sustainability (categories 10-12)
- Ideas directly arising from the structures created at Eden, including the buildings, installations, sculptures, exhibits, performances, and the emotional responses to these (categories 14-15).

Table 5 sets out the analysis of concepts mentioned by each family during their visit. It reveals firstly that the extent to which family talk relates to such concepts varies considerably, and is not correlated with the amount of time spent at Eden: the frequency at which concepts are mentioned (i.e. the number of concepts mentioned divided by total time) is much greater in some families than in others. For example, the child B6 makes over five times as many concept comments as the child G1, and B6 parents make over 20 times as many as G1 parents, even though the B6 visit covered less time. These differences reflect the talk of both children and their parents; it is noticeable, however, that the children make more references to Eden-related concepts than do their parents in almost every case. The frequency of concept-related talk by children (CF) reflects to some extent the amount of time devoted to Eden-related talk, but there is by no means a clear correlation; for example families B2, G2 and G5 all had relatively high proportions of ERT by the child, yet relatively low CF. There was a somewhat better match between the ERT of parents and the CF of child talk: this suggests that the nature of discourse between child and parent may be much more important than the amount of talk. This issue is pursued through the detailed analysis of four cases in a subsequent paper.

During family conversations about science-related issues, Crowley et al. (2001) have observed that parents explain things more often to boys than to girls, and this is born out here, as indicated in table 6. In every category, parents of boys made on average more comments than parents of girls; this was particular striking in the most discussed categories (plant descriptions; emotional responses to things observed; Eden descriptions). This is despite the evidence that girls on average had a higher overall % of Eden-related talk than boys (15.6% as against 13.0%), and that this was the case in all areas of Eden except the WTB.

It might be expected that the frequency of conceptual talk (CF) would be linked to the frequency of questions asked. Whilst it is certainly the case that the family asking most questions had the highest CF, other families do not fit this pattern. For example, child G7 asks more questions than any other, yet parent G7 has a low CF, whilst parent B2 asks more questions than most other parents, yet child B2 has a low CF. Hence it cannot be concluded that asking questions of itself promotes conceptual talk, in either direction. However, further detailed study of specific cases may well indicate that the nature and quality of questions, and the kind of conversations that ensue, has much more bearing on the type of conceptual talk between children and parents.

Table 5: Concepts mentioned by children and parents during their visits

	Code	Concept areas mentioned	B1	B2	B3	B4	B5	B6	G1	G2	G3	G4	G5	G6	G7	Totals
			Number of mentions (child / *parent)*													
1	PD	Plant descriptions	13 *8*	5 *3*	8 *11*	3 *4*	16 *12*	37 *24*	2 *2*	15 *4*	11 *1*	17 *4*	5 *0*	7 *2*	15 *1*	**154** ***76***
2	PTP	Plant products- talk about medicine, paper, construction, fuel, clothing etc	2 *3*	6 *7*	1 *1*	0 *0*	0 *0*	6 *13*	1 *0*	3 *0*	1 *1*	1 *0*	1 *1*	0 *0*	4 *2*	**26** ***28***
3	WP	Wild plant context- talk about natural environments (woodland, forest etc)	0 *0*	0 *1*	0 *1*	0 *0*	0 *0*	0 *5*	0 *1*	0 *0*	0 *0*	0 *1*	0 *0*	0 *0*	1 *0*	**1** ***9***
4	DP	Domestic plant context- gardens, flower shows, plant dependence on humans	0 *1*	1 *2*	0 *1*	2 *0*	1 *2*	4 *10*	0 *0*	0 *1*	1 *0*	0 *0*	0 *0*	1 *0*	1 *0*	**11** ***17***
5	HD	Human dependence on plants- food, water, shelter (basic needs)	1 *1*	0 *0*	0 *0*	0 *0*	4 *3*	3 *4*	0 *0*	1 *0*	0 *1*	0 *2*	0 *1*	0 *0*	2 *1*	**11** ***4***
6	G	Global context	0 *0*	0 *1*	0 *0*	0 *0*	0 *0*	0 *3*	0 *0*	0 *0*	0 *0*	0 *0*	2 *0*	0 *0*	0 *0*	**2** ***4***
7	SQ	Size /quantity context	0 *0*	1 *0*	0 *1*	1 *0*	2 *2*	3 *3*	0 *0*	4 *1*	1 *0*	2 *1*	1 *0*	3 *0*	3 *0*	**21** ***8***
8	HC	Historical/time context	1 *0*	1 *0*	3 *0*	0 *0*	1 *0*	2 *1*	0 *0*	0 *0*	0 *0*	1 *0*	0 *0*	1 *0*	0 *1*	**10** ***2***
9	GC	Geographic context	1 *1*	2 *2*	1 *1*	0 *0*	1 *0*	3 *12*	0 *0*	0 *2*	3 *1*	3 *0*	3 *2*	1 *1*	3 *1*	**21** ***23***
10	PP	Plant processes- photosynthesis, reproduction, life cycles, respiration etc	0 *1*	2 *4*	1 *0*	0 *0*	2 *2*	3 *5*	0 *0*	0 *0*	0 *0*	1 *0*	0 *0*	0 *0*	2 *1*	**11** ***13***
11	EH	Ecology and habitats- food webs, food chains, networks	0 *0*	0 *1*	0 *1*	0 *0*	1 *0*	2 *3*	1 *0*	0 *0*	0 *0*	0 *0*	0 *0*	0 *0*	0 *0*	**4** ***5***
12	EI	Environmental issues- sustainability, conservation, need versus greed etc	0 *0*	1 *1*	1 *2*	0 *0*	1 *1*	1 *3*	2 *0*	0 *1*	4 *1*	2 *0*	0 *0*	0 *0*	2 *0*	**14** ***9***
13	PH	Personal or home context	1 *1*	1 *4*	2 *8*	2 *1*	1 *2*	1 *4*	0 *1*	3 *4*	2 *1*	2 *4*	5 *2*	2 *0*	2 *0*	**24** ***32***
14	EA	Emotional context- aesthetics, fears, likes/dislikes, personal experiences	12 *3*	5 *3*	34 *16*	5 *2*	20 *3*	48 *38*	7 *1*	30 *2*	13 *4*	22 *8*	9 *4*	34 *3*	9 *1*	**248** ***88***
15	ED	Eden descriptions- exhibits, buildings, performances, team, visitors, shop	17 *2*	11 *4*	21 *11*	7 *3*	23 *17*	22 *12*	12 *2*	20 *1*	18 *1*	24 *3*	8 *4*	35 *4*	38 *4*	**256** ***68***
16	SC	School context- relevance to activities done in school	0 *0*	2 *0*	1 *1*	1 *0*	1 *0*	3 *1*	1 *0*	4 *0*	2 *0*	0 *0*	0 *0*	2 *0*	2 *0*	**19** ***2***
Total mentions			**48** ***21***	**38** ***33***	**73** ***56***	**21** ***10***	**74** ***44***	**138** ***141***	**26** ***7***	**80** ***16***	**56** ***11***	**75** ***23***	**34** ***14***	**86** ***10***	**84** ***12***	**802** ***388***
Total recorded conversations at Eden (minutes)			**129**	**175**	**162**	**88**	**279**	**165**	**194**	**145**	**87**	**151**	**104**	**145**	**130**	**1964**

Concepts mentioned by children and their parents

Concept areas were generated from those mentioned by children as part of their Personal meaning Maps. In terms of the actual concepts mentioned, table 5 indicates great disparities between the different categories. The majority (55%) of concept comments fell into the fourth conceptual area, namely comments relating to 'Eden structures' (324: 27%) and 'Emotional context' (likes, dislikes, fears etc) (336: 28%). In contrast, the six 'Contextual' categories had only 14% of all mentions, and the scientific processes category only 5% of all concept-related comments.

Table 6: Average number of conceptual comments made by parents to boys and to girls

Concept area	***Average parental comments to boys***	***Average parental comments to girls***
Plant descriptions	10. 3	2. 0
Plant products- talk about medicine, paper, construction, fuel, clothing etc	4. 0	0. 6
Wild plant context- talk about natural environments (woodland, forest etc)	1. 2	0. 3
Domestic plant context- gardens, flower shows, plant dependence on humans	2. 7	0. 1
Human dependence on plants- food, water, shelter (basic needs)	1. 3	0. 7
Global context	0. 7	0. 0
Size / quantity context	1. 0	0. 3
Historical/ time context	0. 2	0. 1
Geographic context	2. 7	1. 0
Plant processes- photosynthesis, reproduction, life cycles, respiration etc	2. 0	0. 1
Ecology and habitats- food webs, food chains, networks	0. 8	0. 0
Environmental issues- sustainability, conservation, need versus greed etc	1. 2	0. 3
Personal or home context	3. 3	1. 7
Emotional context- aesthetics, fears, likes/ dislikes, personal experiences	10. 8	3. 3
Eden descriptions- exhibits, buildings, performances, team, visitors, shop	8. 2	2. 7
School context- relevance to activities done in school	0. 3	0. 0

Within the first concept area, most comments related only to 'Plant descriptions' (230 mentions, 19%), whilst talk related to the uses of plants- the 'Plants and People' ideas which the PMM study attempted to investigate- had only 9% of comments spread across four categories. One striking observation from the recordings is the extent to which smells engaged children's attention and talk more than any other kind of sensory experience. A good deal of the talk in this

concept area focused on identification of smells and the linking of these to things used at home in cooking, cosmetics, deodorants, waste products etc.

All of the above suggests that, whilst children respond very positively to the experience of Eden, even during repeat visits which were the majority of cases here, the level of cognitive engagement with the 'messages' that the Eden Project is hoping to emphasise is relatively low, if Eden-related family talk is in itself an indicator of social constructivist learning. Allen (2002) however has indicated that most conversations in such contexts are too complex to allow for the kind of speedy yet meaningful analysis that might lead to learning. And as noted above, most families, though they talked, did not engage in such complex conversations very often.

Discussion

The evidence indicates that families spend a limited amount of their time talking about Eden-related issues; that questions play a very limited role in the discourse of most families; and that extended interchanges or conversations which develop ideas are relatively rare amongst most families. At times when families might engage in such reflective talk about their experiences and observations, for example whilst eating lunch, little if any such talk takes place. There also seem to be distinct gender differences in the way mothers and fathers on the one hand engage differently with boys and girls on the other. However, all families seem to need to have periods of silence or non-talk, which cannot easily be encroached upon. Hence there are clear limits to the amount of productive 'learning-talk' that can go on. This highlights how important it is, therefore, for a large undertaking such as Eden to make it as easy as possible for families to meet their extraneous comfort needs, in order to facilitate and encourage productive engagement and discussion.

On the other hand, much of the Eden-related talk directly focuses on what children are observing, and has a strongly affective component, indicating that the emotional impact- what is frequently referred to as the 'Wow!' factor- is powerful, for children and parents alike. Concepts are talked about by the children to a greater extent than by their parents, and to a greater extent than their engagement with adults during school visits can allow. However, the Eden Project's cognitive messages are not being given a high profile within the talk that goes on amongst families during their visits, even though talk is largely directed to things seen, as well as towards information provided. Most often, the function of talk is to draw attention to things and to respond affectively in order to show pleasure, rather than to explore ideas. Very little of the talk by children or parents relates the immediate experience to domestic or school contexts, however, despite the Eden Project's many attempts to do this through strong visual and verbal links between the plants and their everyday importance to people's lives.

The value of such talk as does go on should however not be underestimated. In our observations of school groups, we concluded that children needed to familiarise themselves with what we called the 'Big Picture' before going on to detailed study of specifics; and part of this holistic view is to generate a positive response that will motivate children to enquire further as well as to know where and how to find out more. With families, it would seem from this study that even on repeat visits, engaging with the Big Picture is still an essential part of every visit, especially since (as children frequently observed) things are always changing at Eden. The child making her seventh visit appeared just as engaged and excited by her experiences as the child on his first visit, which suggests that the way Eden is organised encourages visitors to re-focus progressively on new aspects of the experience.

Thus as indicated in earlier studies, knowledge is to some extent 'talked into being' by exploratory talk (Green & Dixon 1993) or what Schegloff (1992) refers to as 'talk-in-interaction'. Learning clearly does not take place instantaneously, at a specific moment or in a specific location, but is best thought of as emergent or dynamic, as part of a flow of activity (Ash, 2003; Barab & Kirshner, 2001; Crowley & Callanan 1998). Non-verbal behaviours, such as gestures, facial expressions and movements, which we were unable to observe using the current methodology, may also be important to the understanding of learning within the web of interaction (Crowder & Newman, 1993; Goodwin & Goodwin 1996). Hence as Rahm (2004) concludes, the evidence above suggests that learning in such contexts is as much to do with participants and their interactions as with the environment encountered at Eden. It may be yet more complex, in that learning will depend on the context-specific way in which interacting families engage with the physical context whilst talking to each other. Roth et al. (1999) have shown that even the structure and arrangement of plants and installations, pathways etc. can have a strong influence on how 'learners' interact.

Looking at the evidence from a socio-cultural perspective, it is important to acknowledge that families might perceive the purpose and value of their visits differently. We have for instance observed that, with school visits, the purpose is perceived differently according to group size and time of year, as well as to do with the immediate impact of the Eden site. For example, large groups visiting in the summer term tend to see it as a 'day out', whilst smaller groups in autumn/spring are more likely to see the visit as learning and curriculum-focused. Ellenbogen (2002) suggests that families bring a 'hidden curriculum' to visits that structures learning in such environments, and that these agendas directly affect the learning that takes place (Falk et al., 1998). However, prior research has to be seen in context; Ellenbogen's study, for example, is of a home-educated child whose family makes frequent educational visits to museums, and as such might be atypical.

Socio-cultural background may have a bearing on the different kinds of talk in the different Eden locations, and the recordings provide evidence of differences between families in the implicit assumptions about their visit. In some families, both parents and children have a clear learning focus; in others, one parent only is engaged, whilst there are families in which very little talk goes on that could be said to be learning-directed. Families have differing motivations and attach differing levels of importance to social interaction, as a consequence of past experiences (Borun et al., 1994; Leichter et al., 1989), some having developed a much wider repertoire of cooperative learning strategies than others. Diamond's observations (1986) suggest that parents take on the role of teachers during visits, though this did not appear to be prevalent amongst most families. There were, however, instances where parents clearly wanted their children to make a good impression, for example by asking the child to 'tell the microphone' what they were seeing or learning.

The role of questions in family learning has been highlighted by this first analysis of the evidence, and will be pursued in more depth through subsequent analyses of case study families. In a context such as this, where the cognitive dimension is strongly science-related, it may be worth considering existing research recommendations such as those from Feasey (1998). In her studies, she concludes that science questions have a range of functions, from establishing what children already know, focusing their attention on specific objectives and identifying significant features, to higher-order matters such as prompting comparisons, identifying problems and eliciting new ideas arising from observations.

The earlier review of children learning in contexts like Eden (Griffin and Symington 1997) has also suggested that learning is enhanced by:

- using a learner-centred approach in which students find answers to their own questions
- encouraging learners to gather further questions during their visit, to stimulate interest in finding out more
- allowing an orientation period
- decreasing detailed examination of artefacts as the visit progresses
- learning through styles that recognise the importance of social interaction (child-child, child-adult).

Within the sample of families recorded, some of these functions were effectively performed by most parents. For example, they drew attention to things and identified features of things seen. In a minority of families, children were actively encouraged by parents to find things out, through helping them to identify problems. There were very few examples, however, of parents encouraging children to make comparisons, raise their own questions or to follow these up independently; and what seemed to be missing from the talk of most (but not all) children was the sense of eagerness to direct their own learning, to become effective independent learners. That is not to say children were not curious; almost all of them came across as interested and excited by the surroundings. What seemed to be missing was an awareness of their power as agents of their own learning, and a wish to explore ideas for themselves.

This phenomenon may originate outside the family. It is noticeable that, in many English primary classrooms, there has been a trend towards structure and uniformity of teaching styles arising out of the imposition of national literacy and numeracy strategies. Children in school have, in recent years, been less likely to undertake free exploration and independent learning. Various authors (e.g. Alexander (2001) have noted the way in which long-standing notions of primary classroom practice in England are repeated and imposed on children's learning regardless of context. Hence children's experiences of visits to contexts such as the Eden Project are likely to be coloured by their association with 'learning' as having to do with being told what to do, working in groups, using worksheets and listening.

Our study tentatively suggests that family interaction differs widely, particularly in terms of the kinds of talk involved, whilst a good deal of talk in all families is positive and motivates children to take an interest in what they observe. However, parents used a limited range of discourse strategies, there being little in the way of questions, conversation and reflective talk that might empower their children to take responsibility for exploring or extending their ideas further, in line with social constructivist theories of learning. The evidence also indicates that the family's own perspective on the purpose of such visits can influence how they interact, and thus potentially how much the children learn.

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[5] This is an Australian review of research, in which 'Museum' includes a range of venues including Science Centres, Galleries etc.

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The Eden Project: An overview

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While the Eden Project is first and foremost a Charity with specific objectives, it remains many things to many people. Situated in the south west county of Cornwall, UK, the Eden Project opened in 2001 and has been built in the base of a disused 14 hectare clay pit. The base of the pit is 60 metres below ground level. Within the pit, 3 "Biomes" have been created. From largest to smallest they are the Outside Temperate Biome, the Humid Tropics Biome and the Warm Temperate Biome. The latter two are covered, creating the largest pair of geodesic display greenhouses in the world.

When first walking into the visual arena of Eden, for many, looking down on the 2 covered Biomes is captivating. The design of the geodesic covered Biomes uses to shapes found in nature: hexagons and triangles, allowing for extensive galvanised free-standing steel internal arches. The plastic membranes of each hexagon are made of ethyltetrafluoroethylene (ETFE), chemically allied to PTFE (Teflon). Each membrane is light weight and self-cleaning.

Eden is a prime example of land reclamation and restoration. Remnants of clay extraction left an inherently unstable rock face, a vast lake in the base of the pit and a colossal volume of spoil dumped around the pit rim. Each of these "challenges" was dealt with in a systematic manner. The rock face stabilised with pins, concrete and highly effective hydro-seeding. The original lake was pumped out and an extensive drainage system put in - the base of the pit is below the water table - on a dry day 22 litres of water are draining into the pit every second. The spoil heap was used in two ways: 1.5 million tonnes of spoil was brought back into the pit to raise the pit depth by 20 metres, hiding the drainage system. The remaining spoil was used to make the necessary 85,000 tonnes of soil for the 3 Biomes.

Eden was designed for 750,000 visitors per year. Year on year, this figure has had to be reviewed: we consecutively had 2 opening years of just under 2 million people. In the third year, 1.4 million visited and we are now on target for our third consecutive year of 1.2 million visitors. This gradual drop in public numbers has been fully expected and with visitor numbers stabilising, strategic and operational planning is now much more successful.

Indeed, data collected over the last 4 years is indicating an average of 42% of people coming to Cornwall for the sole purpose of visiting Eden. Many of these people are staying for a long weekend or extended trip, visiting other venues and staying in associated campsites, hostels, B and B's or hotels. All of this results in additional revenue staying in the county. The beneficial economic impact of people visiting Eden and then spending additional money cannot be over-emphasised. Already over £500 million pounds has been generated in Cornwall since Eden opened.

In the broadest sense of the definition Eden is a botanic garden. However, certainly from both a labelling and collection standpoint, Eden differs from the classic image of a botanic institute. Using some 7,000 species and approximately 300,000 plants as both a foil and a series of purpose

built planting schemes, Eden highlights the vital and exciting role of plants in our day-to-day lives. At Eden it is recognised the associated stories of ethnobotany encapsulate larger messages at both a national and international level regarding the health of this planet and the associated interaction of human development. Correspondingly, all site-wide interpretation stresses (sometimes overtly, sometimes indirectly) case studies, stories and plant facts in a positive manner – emphasising the virtue of questioning and the importance of making a conscientious decision as to how each of us can make a potential difference. This positive slant is not skewed – all stories are told in as balanced a manner as possible.

Additionally, using the compass rose emblem, the individual letters are used to denote not only how information is passed on site, but how Eden staff involved in sourcing and accessing information consciously research it: N stands for nature; E for Economics; S for Society and W for "who decides" and/or the distribution of "wealth" and thus politics. These four global elements provide a balanced combination when discussing the impact of ethnobotany.

As a multi-layered organisation Eden showcases, promotes and actively collaborates with other organisations towards sustainable goals and environmentally sound principles. This collaboration is another major objective of the Eden Trust. Collaborative partnerships are a conscious and pro-active development with individuals, corporations, NGO's, Botanic Gardens and government organisations. Eden partnerships are maintained through a number of departments based in the Foundation Building. Frequently, partners provide the front-line, up-to-date information to our research and interpretative teams. In some cases, these local partners have a financial supply link with Eden. This helps maintain and improve a sense of community and economic sustainability for all involved.

A combination of the above factors attracts a public audience across a broad spectrum of ages, abilities and varying global awareness. While the vast majority of our 1.2 million annual visitors choose to visit Eden out of interest, a percentage of students visit as part of their scholastic studies. In 2005 we welcomed 27,000 formal school visits, of which 5,000 were from formal UK tertiary institutes. The Education team teaches all ages of mandatory schooling and within the past year a tertiary post was created, formally recognising the consistent interest of Colleges and Universities. The majority of lessons for students up to Key Stage 4 are provided in the form of workshops. Lessons for GCSE students and above tend to be lecture and tour based across the site. Significantly, last September, the Education Resource Centre – known as The Core – opened. Maintaining the site wide design brief of biomimicry through architecture, the building uses the mathematical Fibonacci sequence in the roof design. The building not only houses significant interpretation – static and mobile – but provides classrooms and office space.

Interpretation across Eden encompasses more than just formal teaching. Eden prides itself on face-to-face communication and additional methods include the use of a Guiding Team as the front-line, direct interface with the public. The Guides take on a vast amount of base information about the whole site and constantly update their information based on changing seasons, new research, new displays and site wide themes. Eden Guides pass information in a variety of ways: one-to-one interaction with the public, walking through the site, giving tours, workshops and using an interpretation station – a fixed location with props for the public to touch, smell and sometimes taste.

Eden is a place where the arts and sciences meet and across the site art and sculpture are used to further the message of ethnobotany. Correspondingly, the Storytelling Team engages with the public in a theatrical manner to further the message of daily plant use. Costumes, music, puppets, dance, theatre and storytelling are some of the methods used.

As an institute, while Eden stresses sustainable principles and associated methods it is recognised not all site practices are as "green" as possible. Transport remains a case in point. However, internal parameters are used to try and maintain a balance between that which is environmentally sound, socially acceptable and economically viable for ongoing sustainable development.

While car traffic remains an issue in Cornwall (especially in the summer), Eden continues to promote alternative transport. A good train network into and across the county is one example. In conjunction with the rail networks, visitors arriving via St. Austell train station can purchase a combined travel and entrance ticket, paying less overall. Eden supports SUSTRANS (Sustainable Transport) with cycle and walking routes. Visitors to Eden who can prove they arrived by walking or cycling also pay a reduced fee. Additionally, Eden acknowledges the increased use of Newquay airport.

It is firmly recognised that since Eden's inception 5.5 years ago, the use of the word "project" is as much a title as a reality. Eden is far from a finished article and remains a dynamic project of ongoing development. Among the many prospects is the potential for a third covered biome - the Dry Tropics Biome – highlighting the importance of water in arid regions. Eden will remain a venue of being many things to many people.

Biography

Mark Paterson has worked and trained internationally in horticulture. For the last 5.5 years based at the Eden Project, as a qualified teacher of Further and Higher education, he is the Tertiary Education Coordinator.

More than a plant label: Creatively engaging the public

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Introduction

Mission statements of botanic gardens around the world generally incorporate within their aims the increased awareness, knowledge, understanding and appreciation of plants.

In order to achieve this aim, strategies need to be considered and developed to engage visitors, whose primary purpose in visiting the gardens is often to while away time in a peaceful environment, rather than to further their botanical education. Such engagement can be attained through quality interpretation, with a focus on developing a deeper appreciation of particular plants and plant diversity. This, in turn, should lead to a greater understanding of related issues, including conservation and sustainability.

Quality Interpretation

Much has been written on what constitutes quality interpretation, including Tilden's authoritative text *Interpreting Our Heritage* (1977), which establishes a set of fundamental principles of interpretation. Ballantyne et al (2002) state a set of key elements of effective interpretation, including that interpretation should:

- provide novel, varied experiences and avoid repetition
- be based around a theme
- encourage visitors to get involved and give them opportunities to take control of their own experiences
- understand and respect the audience.

Quality interpretation can be achieved through both static and dynamic forms of delivery.

Static Interpretation

Signage on plants is a distinguishing feature of botanic gardens when comparisons are made to parks and private gardens. However, plant labels, while a fundamental and essential feature of every botanic garden, generally do no more than give the names and origins of the plants.

Often the extent of a visitor's engagement with a plant is to read the associated label, the content of which may mean little to the visitor, and view the plant for a short time before moving on to the next plant. This raises questions in relation to getting rich messages to visitors, stirring their emotions and, in general, making a significant difference to how they view plants.

In addressing such questions at the Royal Botanic Gardens Sydney, a variety of strategies have been developed, including the use of more effective signage. It was well understood that signage would be more effective only if it genuinely engaged the viewer and if its messages provided appropriate links to the living collection to which it referred.

Two examples of more effective signage, for *Sex and Death* and *Hot Science Topics*, were developed and put in place recently at the Gardens.

Sex and Death, an exhibition of orchids and carnivorous plants, was interpreted as follows:

'Sex and Death: starring orchids and carnivorous plants' tells the story of plant sex by exploring the fascinating pollination mechanisms of orchids, one of the largest and most complex families of plants. Stunning displays of orchids and carnivorous plants with humorous interpretation tell the story of fundamental evolutionary processes. The seduction of insects by plants, their unwitting cooperation and the cruel deception leading to inevitable death are played out using rare and unusual orchids and sinister carnivorous plants.

The relationship between orchids and their pollinators (which, surprisingly to some people, includes humans!) is interpreted in three themes: 'Seduction', 'Cooperation' and 'Deception'. The fourth theme, 'Death', predominately features carnivorous plants surrounded by dark and shadowy imagery.'

The series of signs for *'Death'*, for example, were each in the shape of a gravestone. They featured large colour photographs of a variety of carnivorous plants and their associated stories.

Hot Science Topics involved a series of signs in various locations within the Gardens, linking the work that a number of Gardens scientists undertake with the living collection. Botanic gardens are 'hot-houses' of scientific research into the biodiversity and conservation of plants. However, many visitors, while understanding that botanic gardens house significant plant collections and are centres of horticultural excellence, are often unaware of the amount of research the resident scientists conduct within the gardens, and more widely.

The fun and thought-provoking sign titles for *Hot Science Topics* were designed to capture the visitors' attention and encourage them to read on. The titles included *'Fungi — not always fun guys!'*, *'Mmm … smell the seaweeds!'*, *'Tea-tree or not Tea-tree?'*, *'Drifting waratahs or continents?'*, and *'Plants … vegetation … landscape … country'*.

Each sign contained a photograph of the relevant scientist/s, a description of the associated research work and its results, and a series of interesting facts under the heading *'Did you know?'*. The sign *'Mmm … smell the seaweeds!'*, for example, contained a photograph of Gardens phycologist Alan Millar and read *'My research work with the Botanic Gardens Trust has resulted in the discovery of more than 50 new species of seaweeds. Look over the wall and if it's low tide you may be able to spot the seaweeds below – especially one that looks like green fettucini, called Caulerpa filiformis, and also a brown kelp called Ecklonia radiata. These are just two of the 2000 different species of seaweeds we have in Australia — the continent with the richest seaweed flora on earth.*

Facts about seaweeds in the *'Did you know?'* section included:

- seaweeds and their relatives (phytoplankton) produce more than half the world's oxygen
- without marine algae, the seas would be sterile and there would be no animals on land (even humans)
- some seaweeds grow up to 30 cm a day
- kelp forests are more productive than rainforests.

Dynamic Interpretation

In addition to the use of effective signage and other static interpretation strategies, the extent of a visitor's engagement with a botanic garden's living collection can be significantly increased through quality dynamic interpretation. Such interpretation engages not only the senses. It also stirs the viewer's imagination and emotions through engagement with wonderful stories about plants, with might include chapters on their biological makeup, provenance, role in local ecology, ethnobotanic use, and conservation issues.

Guided walks are one form of dynamic interpretation used at the Royal Botanic Gardens Sydney. The walks are available to the general public and are conducted by the Gardens' Volunteer Guides, a highly motivated, energetic and very capable group, with a great passion for things botanical.

The Volunteer Guides, with guidance from the Gardens' Education, Science and Horticultural staffs, develop a yearlong program of thematic talks and walks for delivery to the general public, other guides and Gardens staff-members. The program includes daily general-walks and monthly theme-walks within the Gardens, onsite interpretations, and activities undertaken as partnerships with other cultural institutions.

General themes within the program include historical and heritage aspects of the Royal Botanic Gardens Sydney site, plant groups and families, ethnobotanic uses, garden design and sustainability. The Volunteer Guides are responsible for choosing topics and then researching and delivering the associated talks and walks, the majority of which emphasise biodiversity and conservation. The visitors are engaged on a much higher level than is the case when they simply read a sign or a plant label.

The Volunteer Guides are true interpreters! They translate and tell the stories of a vast array of plants that originate in many different countries. The Volunteer Guides are very skilled at their craft, stimulating the senses and encouraging further curiosity. The visitor is treated to learning many intriguing things!

Stimulation of the senses is one of a number of means the Volunteer Guide can use to engage the visitor. For example, an explanation of the oil glands in the leaves of members of the Myrtaceae family of plants will certainly add to a visitor's knowledge of the family. However, when the Volunteer Guide then gives the visitor a leaf of a *Melaleuca quinquenervia*, say, to rub in their hands and so become aware of the oil's characteristic smell, the Volunteer Guide has stirred a sense, and usually further interest. This, in turn, will lead to the Volunteer Guide telling the visitor more about the plant, which might include its use by early indigenous Australians, its current use, the history associated with the naming of the plant, and the plant's horticulture.

The Volunteer Guides often carry props such as seeds, flowers and photographs on a walk to assist them to stimulate the visitors' curiosity, which leads to the development of further knowledge and understanding.

'Onsite interpretation' is another form of dynamic interpretation used at the Royal Botanic Gardens Sydney to engage visitors. Two very popular onsite interpretations at the Gardens relate to the Wollemi Pine and the Grey-headed Flying-fox:

Wollemi Pine (Wollemia nobilis)

At the site within the Gardens of the first Wollemi Pine planted outside the valley in which it was discovered, Volunteer Guides engage visitors with a variety of stories. These include stories about the discovery, current research, the plant's conservation, the first commercial sales, and the ongoing horticulture of the plant. A range of additional materials are used in the presentations, including fossils, mature bark samples, conservation treaties, and posters. The presentations generate discussion and provide the opportunity for the visitor to ask in-depth questions.

Grey-headed Flying-fox (Pteropus policephalus)

On seeing thousands of native Grey-headed Flying-foxes hanging from long-established trees, visitors to the Royal Botanic Gardens Sydney express a range of emotions from anger (because the flying foxes are damaging many of the trees) to curiosity and amazement that so many native animals are roosting in the heart of a large city.

The Volunteer Guides deliver dynamic interpretations in relation to the Grey-headed Flying-fox that do much to increase visitors' understanding of the mammals. This understanding includes the important role they play in the pollination of plants and the sustainability of rainforests, and the challenge of managing a protected species that has lost much of its natural habitat, while properly maintaining the living plant collection. Such dynamic interpretation can change people's attitudes and, at the same time, stimulate interest that can be further developed once the visitor leaves the gardens.

* * * *

The development of partnerships with other cultural institutions can be a very successful way of attracting new visitors to botanic gardens and engaging them with the living plant collection. Theme walks can be developed in relation to, for example, art exhibitions, museum displays, operas and literary works.

Recent examples at the Royal Botanic Gardens Sydney of very successful partnerships with other cultural institutions are:

- *Plants in Opera*, in conjunction with the Sydney Opera House
- *History of Garden Design*, in conjunction with The Design Festival at the Powerhouse Museum Sydney
- *Margaret Preston – Art and Life*, in conjunction with the Art Gallery of New South Wales. This partnership was established to celebrate the work of an early 20th century Australian artist, the majority of whose work had a floral theme. Guided walks were developed in relation to thirty of her most significant paintings, selected by the Gardens' Education staff. The Volunteer Guides researched stories for each painting. Walks were then offered to the Friends of the Art Gallery of New South Wales, a new 'Gardens audience', as well as to the general public. A self-guided trail, a form of static interpretation, was also developed and advertised through both the Gardens and the Art Gallery, as well as being made available on an interactive website.

Conclusion

Educators within the staffs of botanic gardens have a responsibility to contribute strongly to the increased awareness, knowledge, understanding and appreciation of plants, an important aim of botanic gardens. This can be achieved through greater engagement of the general public with plants, and issues such as plant diversity, conservation and sustainability.

Effective interpretation can be static or dynamic – signage which is going to be read, incorporating information and messages for ongoing contemplation, guided walks which not only engage the senses but stir emotions and the imagination, and guides' onsite interpretations that stimulate conversation, discussion and in-depth questions.

The number of people visiting botanic gardens each year, and so having the opportunity to experience quality interpretation, can be extended considerably through the development of constructive and well-coordinated partnerships with other cultural institutions, such as museums and art galleries.

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Biography

Donna Osland is a Community Education Officer at the Royal Botanic Gardens, Sydney, and coordinates the Gardens' Volunteer Guide program. She has developed many education programs for both adults and children and a number of plant-based exhibitions at the Gardens.

The value of an education master plan for the Utah Botanical Center

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An education master plan has been very helpful as the Utah Botanical Center (UBC) has changed and refined its mission. The roots of the UBC date back to 1905 when Utah State University (USU) established a horticulture research farm in Farmington on 27 acres of land. Farmington is 60 miles south of the main USU campus in Logan and 20 miles north of Salt Lake City. The Farmington location was selected to study fruits, vegetables, and ornamental plants that would not grow well in the shorter growing season of the high mountain valley where Logan is located. In 1954, the UBC mission changed as formal botanical display gardens were developed as an outgrowth of the research on ornamental plants. The display gardens covered seven acres and included mature trees, annual flower variety trials, a rose garden, daylilies, iris, and a solar greenhouse. The first master gardener program in Utah was started at the Farmington gardens in 1980. In 1998, the state highway department purchased the gardens in order to construct a highway interchange.

The UBC mission was updated in 1998 as the botanical gardens were moved to a location adjacent to the existing USU research farm in Kaysville, about three miles north of the Farmington site. The new site covers 100 acres, including four ponds which cover 23 acres, 42 acres of public open space around the ponds, and 35 acres of farmland where the formal botanical center is to be built. Through a variety of planning sessions and public surveys, a new UBC mission emerged which focused on sustainable urban landscapes, resource conservation, and water quality. Initial development of the Kaysville site from 1998 to 2001 focused on cleaning up debris from the site, realigning the frontage road, rehabilitating the ponds, and building a greenhouse and office space.

In 2002, the UBC initiated an educational program planning process that was led by an interdisciplinary team of eleven educators from USU Extension, the Utah Botanical Center, the Utah State Office of Education, and the Davis School District. Jeremy Call, a USU graduate student in Landscape Architecture, was the coordinator of the team. The team's goals were to: 1) select the type and sequence of new and existing educational programs; and 2) assist in resolving issues such as staffing, funding, and site improvements. Over a period of twelve months, the team conducted two surveys, six group process meetings, and 33 interviews with a variety of stakeholders to develop a list of priority programs. The project coordinator visited 17 other botanical gardens and nature centers to solicit their input and observe successful programs.

This input was prioritized by considering the UBC and USU mission, potential funding sources, projected audience needs, cooperation or competition from similar programs, and the expertise and limitations of staff. The wide range of needs and preferences were grouped into general themes and then ranked by the team members. The team summarized their findings into immediate-term and long-term prioritized programs for different audiences such as K-12 students,

general public, university students, and horticulture industry professionals. The education plan brought many diverse elements together and helped sequence the construction of facilities and gardens with the development of additional educational programs and staff.

The final 250-page education master plan was condensed into a 15-page executive summary. The summary was a valuable tool to communicate results of the educational planning process to decision makers and funding sources. Parts of the summary are available at the UBC web site: www.utahbotanicalcenter.org.

The education plan was completed in 2003; and at this same time, two new educational facilities were also completed. The Utah House (UH) is a 2,500 square foot sustainable building demonstration house and learning center. The furnished house demonstrates practical ways to save energy, water, and money in housing and landscaping. The Garden View Pavilion was funded by Davis County and provides a large, covered area for teaching and field trips. The education plan lists 61 possible programs that could be implemented from 2003 to 2008. To date, about one-third of the suggested programs have been implemented. This paper describes some of the major programs that have been implemented and what has been learned.

Staff and visitors

The UBC education staff was expanded by hiring a coordinator for the Utah House, an education coordinator for the UBC, and an Extension Horticulturist. Funding for these positions came from federal grants, state and county funding, and internal budget reallocations. Many programs have been implemented with this additional education staff, expanded volunteer training, and re-direction of existing resources. More staff and additional programs have led to an increase in visitation. In 2002, there were only about 150 students who visited the UBC. In 2003-2004, the Utah House and UBC had over 7,000 visitors, including 1000 K-12 students. In 2005, the UBC had over 10,000 visitors including 2800 K-12 students.

K-12 students

A series of field trips to the UBC were developed to fulfill the requirements of the Utah State Office of Education K-12 core curriculum in horticulture, wetlands, wildlife, energy, and water conservation. These camps were very popular and registrations filled up quickly. Teacher evaluations showed high levels of satisfaction with the field trips, particularly their correlation with the state core curriculum.

In 2006, five different summer camps were offered including Nature Art, Water Adventures, and Slimy Adventures (bugs, bats, and critters). In 2005, a series of Boy Scout merit badge workshops was started on Gardening, Landscape Architecture, Environmental Science, and Bird Study. A total of 70 scouts earned 92 merit badges. Boy Scouts working on their Eagle Badge service project have helped improve UBC facilities by building bird houses, removing pond weeds, and planting trees and shrubs. Since 2001, a total of 30 Eagle Scout service projects have been completed.

A popular activity at the Utah House has been family night activities. These activities are advertised to the surrounding neighbors by a highway signboard and doorstep flyers. Family nights include short, fun craft activities for youth and tours of the house. The most popular family night was “Pumpkinpalooza” which attracted 400 people for pumpkin carving and a visit from an owl from the Ogden Nature Center. An on-line survey of people who had visited the

Utah House showed a significant increase in visitor's knowledge about these specific topics: Energy Efficiency (98%), Water Conservation (98%), Sustainability (93%), and Healthy Indoor Environments (87%).

In 2005, a 4-H youth fishing camp was started at the UBC ponds. The camp program is held once a week for six weeks and includes a lesson manual, a short lesson about fishing each week, and then practicing the lesson with an adult leader out on the ponds. This program continued in 2006 and a total of 65 youth have participated. An evaluation of fishing camp showed a 72% increase in knowledge about fishing. One insightful comment from the evaluation was: "What a great program for kids. It gets them outside in the fresh air and away from playing video games."

General public

In 2003, a unique new program was tried where greenhouse and nursery owners and UBC staff taught a series of classes on landscape design and winterizing your landscape. The goal was to involve local green industry professionals in teaching classes. The classes were very informative and well attended, but the concept was put on hold due to concerns from the Landscape Nursery Association.

The one-acre water-wise landscape around the Utah House has been an important component of many programs. The landscape has attracted attention because it is along a busy street, it has filled in and looks complete, and the landscape is colorful year round. In response to many requests, a brochure was prepared listing the plants in the landscape. The plants are grouped into Very Low, Low, Moderate, And High Water use zones. A list of local landscape designers who specialize in water-wise design is being prepared as a companion publication. A series of Saturday morning gardening classes was conducted every other Saturday through the spring and summer of 2005 and 2006. The classes are taught my master gardener volunteers and topics included fruit tree pruning, vegetable gardening, perennials, container gardening, and water-wise landscaping.

In 2005, UBC staff and master gardeners had a unique opportunity to help design and plant a garden for the TV show "Extreme Makeover Home Edition." The UBC donated daylily and iris plants. Master gardeners designed and planted a natural area along a stream in the backyard. Other master gardeners directed the planting of the vegetable garden and raspberries. Over 40 master gardeners helped with this project.

A week long Spring Celebration Program was held at the UBC in 2006 with classes on vegetables, parking strip design, and container gardening. A special guest lecture by Peter Lassig, a renowned local landscape designer, attracted 70 people. A water-wise plant sale had proceeds of nearly $2,000 to help with future garden development. In all, over 500 people participated in the program. Not every program has been a success. This year, a program of evening garden walks at the Utah House landscape was offered for several weeks, but had to be cancelled due to a lack of response.

University students

With completion of the greenhouse facility in 2001, offerings of off-campus USU credit horticulture classes were increased. A total of 18 different classes have been taught on a rotation

basis. Some of the most popular classes include: Sustainable Landscapes, Annual and Perennial Plants, Native Plants, Pest Management, and Introduction to Landscape Architecture.

The last two years, the UBC has participated in a state-wide intern program for college students sponsored by the Utah Agricultural Experiment Station (UAES). The goal of the program is to provide on-farm work experience, especially for students from urban areas. The students assist with research and demonstration projects at various research farms operated by UAES across the state.

Horticulture industry professionals

Programs in this area are the least developed at this time. A major research project at the UBC is on pot-in-pot tree nursery production. This project will provide up to date information on best production practices to plant nursery growers when the research data is compiled next year. A replicated trial of 10 fall-bearing and 17 spring-bearing raspberry varieties was established in 2006. In a couple of years, this trial will provide important information to raspberry growers and plant nurseries.

Facilities

Staff and facilities are key components in conducting educational programs. Some important improvements in facilities over the last few years are: signs for self-guided tours of the Utah House, a new shade house for nursery production, and planting of the Legacy Teaching Garden by the greenhouse. This garden will be an important tool for teaching public gardening classes and university credit classes.

Future projects

Some projects planned for completion in the next couple of years include a street tree demonstration arboretum, fire wise landscaping demonstration, small pasture demonstration plots, and a replicated trial of native shrubs and perennials for landscape use. Also planned are a farmers market at the UBC pavilion, a wetland discovery lab, and a master naturalist education program.

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Presenter Biography

Shawn Olsen is the Davis County Director for Utah State University Extension and served as a member of the Utah Botanical Center education master plan team.

Promoting education in Japanese botanic gardens

Dr. Junko Oikawa, Japan Programme Co-ordinator

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Japanese botanic gardens and the Japanese Association of Botanical Gardens

Botanic gardens are very popular in Japan and there are more than 200 botanic gardens and similar organisations in total, being distributed almost evenly throughout the country. Their history goes back to the seventeenth century, when the oldest Japanese botanic garden, Koishikawa Botanical Garden of the University of Tokyo was originally developed in different site in 1630s' as a medicinal garden for Shogun Tokugawa Government (Iwatsuki, 2004). The newest project which is owned privately, on the other hand, is found in Hokkaido, and is currently under development to be opened in spring 2008.

The Japanese Association of Botanical Gardens (JABG), co-ordinating and networking botanic gardens in Japan was established in 1947 by the representative of botanic gardens in Japan and became an authorised national corporation recognised by the Japanese government in 1966 (Japanese Association of Botanical Gardens 2005). The objectives of JABG are "to facilitate communication between botanic gardens in Japan, to increase understanding and address issues by sharing relevant information from inside and outside the country, and to undertake development of botanic garden activities"(Suzuki 2006). Currently, JABG has around 130 institution members and 70 individual members.

Education at Japanese botanic gardens

Education has been traditionally considered as a role of botanic gardens in Japan and many botanic gardens have run some kinds of education programmes. Today, the variety of the programmes has become more diverse than in the past, in parallel with increasing interests in education in general within the Japanese botanic gardens' community. Some characteristics of education in Japanese botanic gardens are seen as;

- targeting adults than children
- passive than active
- "about" than "for"
- isolated than collaborative

- public service than educational

While critically reviewing and comparing with ones happening both in the world botanic gardens' community as well as in the national education movement, education at Japanese botanic gardens could be still regarded as in very early stage, and there are obviously urgent needs to change, improve, and develop further.

However, there are some problems and barriers which make botanic gardens' education in Japan difficult to grow. One critical factor is a lack of communication, collaboration, and networking. Exchanging ideas and experiences on education amongst botanic gardens, or working in collaboration with other botanic gardens for developing education programmes are rarely seen. Also their links with outside such as similar organisations like zoos or museums, and local educational establishments including local schools are almost none, or very limited if any. Botanic gardens are very rarely seen in any education forums or communities in the country.

The other, but perhaps the most serious problem is there is still a lack of recognition about importance, values and opportunities of botanic gardens education, both inside (particularly by those who has responsible for the garden management) and outside (including governments, stakeholders, and general public) of the botanic gardens' community in Japan. The fact that none of Japanese botanic gardens has education staff and very limited budgets, if any, are allocated for education at many botanic gardens clearly suggests how little education at botanic gardens is valued. Being regarded as important does not always mean as a priority. Other practical aspects seen in education at Japanese botanic gardens, such as a lack of policies, strategies, and planning, a lack of new ideas, and a lack of evaluation and research, etc. may also fulfil, if botanic gardens are more to be seen as important centres for education in Japan. This might be also rooted from the social understanding of what roles botanic gardens should play and the general public view of how botanic gardens are seen and expected to be in Japan. The situation of botanic garden education may not be changed in Japan without much more attention and efforts to influence this.

Travelling Exhibition "Plants for Life – For Plants and Our Future ": Investing in Nature Japan Programme

Investing in Nature Programme is a five year environmental partnership funded by HSBC, working with BGCI, Earthwatch, and WWF. Having been started in January 2004, BGCI's Investing in Nature-Japan programme has provided the great opportunity to establish a working relationship between BGCI and Japan, to support plant conservation in Japan as well as to

promote education in Japanese botanic gardens.

One of the projects of this programme proposed was a travelling exhibition at botanic gardens. It was aimed to raise public awareness of the importance of plant conservation and the botanic gardens role in plant conservation. Through several discussions and consultations with people being involved in plant conservation in different sectors in Japan, the original idea of this project has become the first national event of its kind, organised in collaboration with BGCI, the Ministry of the Environment, and JABG. It has also assisted by some NGOs including WWF-Japan and Earthwatch-Japan, partners of Investing in Nature, in Japan, and a national newspaper, with being in co-operation with and participated by a botanical artists group. It was decided to be as an exhibition on endangered plants.

The exhibition called “Plants for Life – For Plants and Our Feature” targets adults and teenagers. Its display starts by exploring about why plants are important, and reminding the native flora in Japan and the traditional and mutual relationship of Japanese people with plants in culture, history and everyday life. It then explains the facts and the causes of the loss of plant species, and questioning what does this environmental disaster mean to human and the earth. While addressing conservation needs, examples of practical activities and projects in different levels and scales, including the role of botanic gardens in conservation are presented. It then concludes by calling for actions for a positive feature. For further information, a booklet was developed to assist the panels and flyers and posters were also published for advertisement.

The exhibition travelled seven botanic gardens for eight months in 2005. Each garden was strongly suggested to organise local publicities, to produce original panels for promoting own garden, and to run some education programmes in relation to the exhibition during the time of its running. In order to evaluate the project, each hosted garden was requested to produce a report following to the single format including the results of the questionnaire survey provided by JABG to the visitors.

Generally, public feedbacks to the exhibition were positive (Table 1) and the exhibition brought more visitors and local media to all host gardens. Some common results amongst hosted gardens were also found in the reports and by the internal feedback. Those include, ineffective use of posters and flyers for advertisement, a lack of promotion and invitation to local schools, lectures as the most common form of education programme, and stronger impact by local stories than ones in national/general.

Table 1. Examples of the comments from the visitors to “Plants for Life – For Plants and Our

Feature" Exhibition

- did not know plants are also in danger of the species loss
- did not know some familiar plants in our traditional culture and literature are now threatening
- have better understanding about the local flora
- want to know what I can do
- have better understanding of the role of botanic gardens in conservation and their conservation practices
- should be run regularly
- important subject
- want to see more living plants (with flowers)

The successful outcomes encouraged the project to grow to continue to run for the second year, and further, to go out from botanic gardens for the first time. In 2006, the exhibition will be displayed at nine botanic gardens, and a public open space in the middle of Tokyo. Values and appreciations of "Plants for Life - Our Endangered Plants" exhibition could be also recognised by its achievements of;

- promoting Japanese botanic gardens collectively
- providing an opportunity for a collaboration between botanic gardens and the central government
- highlighting the need for partnership and networking in plant conservation
- encouraging Japanese botanic gardens to recognise their education role

Conclusion

The new governmental policy to introduce a contract system into botanic gardens may put Japanese botanic gardens into the most difficult period in their history today (Suzuki, 2006). BGCI should encourage and support Japanese botanic gardens to mobilise for raising national debate and public opinion towards the values of botanic gardens. It is believed that promoting education in botanic gardens at national level, such as "Plants for Life-For Plants and Our Feature", will help them to open their eyes to new role in the society, and contribute to the positive change of education at Japanese botanic gardens, as well as Japanese botanic gardens as a whole.

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The Gaia Theory – Scientific Model and Metaphor for the 21st Century

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Abstract

This paper introduces the Gaia Theory, a compelling scientific context for understanding life on our planet. The theory asserts that the organic and inorganic components of Earth form a seamless continuum - a single, self-regulating, living system. British scientist, James Lovelock, who was commissioned by NASA to determine whether or not there was life on Mars, developed the Gaia Theory in the 1970's. Ironically, this theory has yielded some of the most "cutting edge" insights into life on Planet Earth. For example, Lovelock found ways in which the Gaian system regulates surface temperature, ocean salinity, and other conditions at levels necessary for life to survive. This paper also includes discussion about the value of the Gaia Theory for environmental educators.

In the 1970s, James Lovelock, a British scientist, was taking a walk in the English countryside with his neighbor, William Golding (the author of *Lord of the Flies)*, telling him about his newly crystallizing views about life and evolution. It appeared to him that organic and inorganic (supposedly "inert") parts of Earth had evolved together as a tightly coupled living system that was self-generating and self-regulating. The entire planet, he told Golding, seemed to behave as if it were a single living entity. Hearing this, Golding made a suggestion with profound implications for science and society in general - Lovelock should name his theory the "Gaia Theory" after the ancient Greek Goddess of Earth. After all, Golding reasoned, ancient Greeks thought the Earth was alive, and science was now rediscovering this important worldview.

Like most new theories - especially grand, sweeping theories such as evolution and plate tectonics before it - the Gaia Theory was ignored or ridiculed for many years. Lovelock had taken an unusual step when he named the theory "Gaia" instead of a more technical appellation such as "geophysiology," or "Earth system science." To many scientists, "Gaia" connoted mysticism and they distanced themselves from the idea. Others took issue with Lovelock's claims that the superorganism of Earth could self-generate or self-regulate, citing the lack of demonstrated mechanisms by which Gaia could exist.

Relatively quickly, however, Lovelock's research yielded compelling evidence to support his theory. He showed that the Gaian system regulates atmospheric gasses such as oxygen, methane, carbon dioxide, and hydrogen sulfide that react with living beings. The maintenance of oxygen near 20% in the atmosphere for at least 400 million years is an example. Likewise, ocean alkalinity, air temperature and other environmental factors were shown to be regulated by life. Lovelock and colleagues explored ways in which climate and the global sulfur cycle are moderated by oceanic microorganisms that release gasses that influence cloud formation. Even though the sun has increased its radiance (and thereby, its potential to heat the Earth) by almost a third during the time span of life on this planet, the Gaian system has maintained temperatures within a fairly narrow range suitable for its own existence. Myriad processes including feeding, excretion, breathing, reproduction, lightning, water condensation, and untold others dance together in the Gaian system that self-regulates conditions critical to life within narrow limits.

Lovelock describes Gaia in the following manner: "Gaia is the Earth seen as a single physiological system, an entity that is alive at least to the extent that, like other living organisms, its chemistry and temperature are self-regulated at a state favorable for life. Gaia became visible through the new knowledge about Earth gained from space and from extensive investigations of the Earth's surface. It is concerned with the working of the whole system not with the separated parts of a planet divided arbitrarily into the biosphere, the atmosphere, the lithosphere and the hydrosphere."[1] In even more succinct fashion, he notes that "Its [the Gaia Theory's] major difference from older evolutionary theories such as Darwinism is that it sees organisms not just adapting to the environment, but changing it as well."[2]

These realities of evolution were rediscovered in the 1970's by Lynn Margulis, now an evolutionist at the University of Massachusetts. Her own "endosymbios theory of cell evolution" was quickly accepted by scientists and showed that there was much more to evolution than Darwin could have known. The building blocks of all life – and evolution – are microorganisms that Darwin could not see. Physiologic behavior and community activities of microbes enmeshed the metabolism of different kinds of organisms billions of years ago, and *this became the foundation for all subsequent evolution.*

Lynn Margulis became an enthusiastic supporter of James Lovelock and the Gaia Theory. She collected information about microbes that underlies the understanding of how life controls Planet Earth's climate, ocean salinity and atmospheric content. One of the ways in which this happens is through carbon burial. Over eons, microbial life has incorporated carbon dioxide – the gaseous form that carbon takes in the atmosphere – into solid rock such as limestone (CaCO3). With large amounts of carbon sequestered in limestone (and carbonaceous "fossil fuels") – and thus prevented from reacting with oxygen – carbon dioxide levels decreased from about 95% of atmospheric gas when life began to the 0.03% it is today. Carbon dioxide is one of the most effective "greenhouse gasses" (gases that trap heat in the atmosphere). Despite the fact that the sun is about one third brighter now than it was when life began, our blanket of carbon dioxide has thinned at just the right rate to maintain temperatures suitable for life.
Lynn Margulis has long seen a profound intersection between her work in microbiology and Lovelock's Gaia Theory. "My primary work has always been in cell evolution, yet for a long time I've been associated with James Lovelock and his Gaia hypothesis. In the early seventies, I was trying to align bacteria by their metabolic pathways. I noticed that all kinds of bacteria produced gases. Oxygen, hydrogen sulfide, carbon dioxide, nitrogen, ammonia — more than thirty different gases are given off by the bacteria whose evolutionary history I was keen to reconstruct. Why did every scientist I asked believe that atmospheric oxygen was a biological product but the other atmospheric gases — nitrogen, methane, sulfur, and so on — were not? 'Go talk to Lovelock,' at least four different scientists suggested."[3]

In 1948, Sir Frederick Hoyle, a British astronomer, wrote "once a photograph of the Earth, taken from the outside, is available . . . an idea as powerful as any other in history will be let loose." It seems as if that powerful idea is now taking shape in the form of the Gaia Theory.
The theory is at the brink of mainstream science and has arrived at this point faster than most theories of its magnitude.

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[1] Lovelock, James, 1991. Healing Gaia: Practical Medicine for the Planet. Harmony Books: New York.

[2] Transcript of an online chat, Friday September 29, 2000. http://www.ecolo.org/lovelock/lovelock-online_chat-00.htm

[3] Brockman, John. 1995. The Third Culture: Beyond the Scientific Revolution. Simon & Schuster: New York.

The Gaia Theory as a Context for Science and Education

The Gaia Theory is, perhaps, the richest context for science and education in existence. The study and contemplation of this idea will yield questions and research that will help us address future needs. Many notable and influential personalities have begun a drumbeat of support for a new way of thinking underpinned by the basic concepts of the Gaia Theory.

In his July 4, 1994 address at Independence Hall, Philadelphia, on the occasion of his receiving the Philadephia Liberty Medal, Vaclav Havel said:

"The idea of human rights and freedoms must be an integral part of any meaningful world order. Yet, I think it must be anchored in a different place, and in a different way, than has been the case so far. [One example] is the 'Gaia hypothesis.' This theory brings together proof that the dense network of mutual interactions between the organic and inorganic portions of Earth's surface form a single system, a kind of mega-organism, a living planet, Gaia.[4]

Freeman Dyson, an eminent physicist, and formerly a tireless champion of space exploration, shifted his focus later in his life and came to essentially the same conclusion as Havel:

"One hopeful sign of sanity in modern society is the popularity of the idea of Gaia, invented by James Lovelock to personify our living planet. Respect for Gaia is the beginning of wisdom. . . . As humanity moves into the future and takes control of its evolution, our first priority must be to preserve our emotional bond to Gaia.[5]

Consider the words of ecologist and inventor, John Todd:

"Ecology as the basis for design is the framework of this new economic order. It needs to be combined with a view in which the Earth is seen as a sentient being, a Gaian worldview, and our obligations as humans are not just to ourselves, but to all of life. Earth stewardship then becomes the larger framework within which ecological design and technologies exist." [6]

Even Aldo Leopold, whose book "A Sand County Almanac" has been a staple for students of natural sciences for many decades, also foresaw the basic premise and importance of the Gaia Theory when he wrote: "The land is one organism. Its parts, like our own parts, compete with each other and co-operate with each other" [7]

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[4] Havel, Vaclav. 1994. The Miracle of Being: Our Mysterious Interdependence. Acceptance speech for the Liberty Medal presented at Independence Hall, Philadephia, Pennsylvania, on July 4, 1994.

[5] Dyson, Freeman. 1988. From Eros to Gaia. New York: Pantheon Books.

[6] Todd, John. 1987. An Ecological Economic Order In Gaia: A Way of Knowing; Political Implications of the New Biology. ed. William Irwin Thompson. Lindesfarne Press: Great Barrington, Massachusetts.

[7] Leopold, Aldo. 1949. A Sand County Almanac. Oxford University Press: New York..

Of course, the words of famous personalities or scientists do not suffice. We must test these ideas against diverse sources of knowledge and truth before using them with confidence. Therefore, I urge scientists to study the Gaia Theory and see how it stacks up against modern scientific inquiry, ancient and traditional thought, common sense, empirical observations, and other ways of knowing.

Initially, the most powerful value of the Gaia Theory may simply be that of providing scientists a compelling and meaningful context. Recently, there has been much talk of "interdisciplinary education." But how can we conceptualize interdisciplinary education without a clear vision of what life is as a whole? Consider the black spots in figure 1.

It is difficult to see any pattern inherent in these spots until first looking at figure 2. The illustration of the dancers in figure 2 allows our brains to grasp the relationships between pieces that previously appeared to be random. The concept of a living Earth, Gaia, can provide us with just such a vision of how all of the pieces of <u>life</u> fit together.

Huge schisms between disciplines even within the natural sciences might be bridged as we think at the Gaian scale. For instance, it is now known that the maintenance of ocean salinity (at 35 parts salt per thousand parts water) over at least hundreds of millions of years is a result of the interplay of climate, soil chemistry, coral reef formation, geologic processes, and many other factors. Scientists in these various disciplines are now beginning to communicate with one another and discovering that their fields are like different faces of the same system.

One of the most fascinating interdisciplinary links to be made is the true place of human society in the Gaian system. We begin to see human cultures and even religions as marvelous, biological adaptations of human beings that enmesh with the rest of life. With this viewpoint, we can rise to the challenge of adapting culturally to enable us to live in better balance with the rest of nature.

Two ways of looking at a botanic garden: Science and education as activating forces

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Introduction

México is one of the 12 megadiverse countries that together contain about half of the world's biodiversity. Nearly 10% of known vascular plant species can be found in México, owing to its intricate topography that leads to numerous microenvironments, and to the convergence of Neartic and Neotropical biotas in this country (Neyra González & Durand Smith 1998). México is also a culturally rich country. The presence of more than 50 indigenous groups provides us with a long history of human interaction with environment.

In the context of the current environmental crisis, we consider important to relate Mexico's biological and cultural values to the work developed within scientific institutions. The interaction between scientific knowledge and the natural and social capital should generate new forms of interaction between society and the environment. These interactions should help to conserve the portion of planet under our custody. This is one of the goals of the Centre for Ecosystems Research (CIEco, from its Spanish acronym).

The Centre for Ecosystem Research is a recently created entity of the National Autonomous University of México (UNAM). CIEco was created by a group of academics interested in developing interdisciplinary, applied research that can contribute to sustainable development. As a research centre, CIEco's main functions are the production of scientific knowledge, teaching and professional training of scientists and technicians. Communication of science to non-scientific audiences and environmental education were acknowledged from the beginning as important activities to be conducted. In this sense, we conceive an adaptive interaction with non-scientific audiences, where the audience has the capacity to respond and demand the knowledge that is been shared between all the actors involved.

CIEco is working to foster an open relationship between scientists, scientific knowledge and society. Raising environmental awareness and promoting the participations of citizens in solving environmental problems is an important part of this strategy. The creation of a Botanical Garden is a key element to achieve this aim.

In this contribution our main objective is to share our experience in developing a proposal to create a Botanical Garden in the state of Michoacán, located in west central México. A team of plant taxonomist who also has experience on management of plant collections initiated the proposal. As the project developed, CIEco's unit of science communication and outreach got involved in order to include an educational perspective. What we describe here is a reflection on the process of work to generate a common project for the botanical garden. Our goal is to develop a strategy to create a botanical garden that can work as a window that CIEco could use to communicate with society in order to promote the construction of sustainability.

A botanical garden in West México

The state of Michoacán in west central México is among the five more biologically diverse states in the country. More than a dozen vegetation types can be found and, unfortunately, all of these communities present some form of transformation or degradation due to human activities such as agriculture, cattle ranging, urban growth, or invasion of secondary vegetation after abandonment. This generates an urgency to implement ways to rescue, restore and conserve the plant diversity of Michoacán (Carranza 2005).

In the last few decades, botanical gardens have become important centres for biodiversity conservation, playing a role in integrating conservation and development (Wyse & Sutherland 2000). On the other hand, education is also recognized as a valuable instrument to promote the study, conservation and raising of awareness regarding the importance of ecosystems and the role of plant diversity in human survival. We consider that environmental problems have their roots in the nature of interactions that societies have with natural systems. Public places such as the museums, zoos and botanical gardens can become important centres for education for sustainable development (Willison 2006).

There are 89 botanic gardens registered in México by the Botanic Gardens Conservation International. Many of them, nevertheless, are not in function or have just started to be developed. In the state of Michoacán, and in spite of the recognition of its rich plant diversity, there are no botanical gardens. Is in this context that CIEco is developing its proposal to generate the first botanical garden in the state.

CIEco's Botanical Garden Proposal

In 2005, authorities of UNAM assigned CIEco the responsibility to develop a proposal for the creation of a botanic garden at its campus in Morelia. An experts committee of CIEco was formed and initiated the development of the initial plan for the botanical garden.

This first version of the botanic garden proposal had as objectives to develop some botanical collections where scientists could develop research, take action in conservation and exhibit Michoacán's plant diversity. These objectives also considered an environmental education plan and the creation of some ecosystems goods and services in the Morelia region. Another important part of the original proposal was a series of well-detailed technical considerations. The technical staff thought about physical and geological aspects of the area where the botanical garden will be. They also considered physical facilities, types of plant collections and botanical garden maintenance, management, and administration. However, some important elements of a botanical garden were overlooked in the proposal: an integrated education master plan that considers specific objectives related to communication, public participation and awareness on biodiversity and conservation according to the Global Initiative on communication, education, and public awareness that the Convention on Biological Diversity is developing.

Integrating the educational perspective

The experts committee in charge of developing the botanical garden creation proposal presented it to the entire academic community of the Centre. In this first meeting, it became clear to some researchers and to the members of the CIEco's Unit of Science Communication and Outreach the need to develop not only an educational proposal but to include this perspective since the beginning of the project. The experiences carried out in public educational places such as

museums tell us of the relevance to recognize and educational purpose when constructing and exhibition. This purpose, nevertheless, should be clearly stated in the mission of an exhibition, or in our case, in a botanical garden project.

After discussing different points of view, we concluded that the mission of CIEco's botanical garden is "to contribute to the study and conservation of Mexican flora, and to promote among the public an interest to know, conserve and use in a sustainable way the plants and ecosystems of México." As a research institution our interest is also that the botanical garden will serve as a window through which we can share with society the scientific work that we conduct and all the activities that CIEco implements to contribute with the construction of sustainable development.

From this perspective, we worked together also on the main objectives, which include:

1. To conserve seeds, propagules and Mexican plants *ex situ.*
2. To support CIEco's research and teaching activities.
3. To show visitors Mexico's native plant diversity.
4. To share with visitors knowledge about plants, ecosystems and regarding the human interaction with nature generated at CIEco.
5. To promote an environmental culture through the raise of awareness on environmental issues.
6. To offer a cultural place for the joy and recreation of the local community.
7. To be and important place in the city of Morelia which reflects UNAM´s cultural richness and academic activity.

After agreeing on the mission and new objectives, a new team was conformed by botanical garden staff and members of the Unit for science communication and outreach. It has been a challenging experience to work in the search for an integrated master plan, which considers equally important technical aspects of the plant collections and the need to develop an education perspective essential for the future visitors.

An aspect that was difficult to address, was the identification of the main messages that we want the public to take with them. We came up with three main conceptual themes that we consider the botanical garden should be build around:

- Mexico's plant and ecosystems diversity: to show visitors the plant diversity of the country and its importance through its eco-regions.
- CIEco´s research activity and its role in the search of sustainability: to share with visitors our passion for scientific research and the relevance of the knowledge we generate that contribute to explain the structure and functioning of ecosystems and their relationship with society.
- Awareness about our planet's environment situation. - To see the botanical garden as a space through which society can recognize some goods and services that ecosystem provide to us, to promote their participation and action on proposals that solve environmental problems and help the maintenance of life sustaining processes.

With the purpose of using the experience to reflect, discuss and construct better ways of interdisciplinary work, we constructed the following table that shows the main differences in the initial conception of CIEco's Botanical Garden.

	Technical point of view	Education point of view
Mission	Lack of explicit mission	Includes: ex situ conservation, research and docent activities, diversity of visitors, environmental education, cultural site
Messages	Human activities viewed as threat Plant extinction Emphasis on negative aspects of human interaction with plants	Mexican plant diversity CIEco´s research activity Environmental Awareness Emphasis on positive aspects of human interaction with plants view
Education	Viewed mainly as family recreation	Focused on identifying target audiences, constructing communication processes, Emphasis on visits as learning experiences for the public
Infrastructure	Services Maintenance Research Plant exhibitions Some areas to attend visitors Shop, classroom space	Specific areas to develop education activities Areas for enjoyment and contemplation of panorama
Type of plant collections	Focused on: plant problematic, uses and biological processes Arboretum, Threatened plants Thorn scrub Agaves collection Mexican traditional orchard Mexican fruit collection Palmetum Aquatic and riparian vegetation Pollinators garden Epiphyte collection Vines Weeds Medicinal flora Microcosms Graminaceous plants	The same groups of plants organized according to Mexico's eco-regions. Emphasis on the arrangement of plant collections in terms of constructing messages to the public. These messages will help visitors understand the ecosystems and plant diversity, as well as the relations with people's everyday lives.

Final Remarks

Scientists and authorities at our institution are aware of the relevant role that botanical gardens play in supporting environmental awareness, public education, and the need to promote participation of society in solving environmental problems. They are also enthusiastic about the opportunity that the botanical garden can give to our institution for sharing with society the scientific activities that are developed at CIEco.

Our experience so far, has been challenging, particularly in relation to giving an equal importance to the technical and educational aspects of the botanical garden. The technical team had put much emphasis in the development of plant collections for research and conservation purposes, while educators strongly emphasize the role of the garden as a public place where people go to learn and enjoy nature. Equilibrium in the function of CIEco´s botanical garden has been reached and will be implemented during the garden construction and operation.

We are convinced that botanical gardens affiliated with research institutions are considered ideal places to relate scientific activities with society. These botanical gardens may be places to develop strategies focused on communication, education, and participation of scientists, technicians and non-scientific audiences. Finally, botanical gardens are places that inspire visitors, the local community, and scientists to take action towards conserving plant diversity.

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Biography

Ana Claudia Nepote

I am a Mexican biologist whose main interests are ecosystem studies, environmental education and science communication. Since 2005, I work at The Centre for Ecosystem Research of the National Autonomous University of México (UNAM). I am part of a team that is developing a proposal for the creation of a Botanical Garden in the city of Morelia, Michoacán.

Urban green spaces: Lungs of the city and centres of biodiversity education

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Centre for Environment Education, India

Introduction

Natural heritage sites like National Parks and Wildlife Sanctuaries play a major role in conserving flora, fauna and representative ecosystems. Since they are visited by a large number of people they also have a great potential in promoting appreciation and interest in wildlife and public awareness on biodiversity, conservation and sustainable use of natural resources.

But the environment is not just about national parks and sanctuaries, even though the preservation of wildlife and natural habitats is important. It is also about the quality of life in townships and cities: the shade of trees, space for children to play, and a place for old people to sit and remember; and it is about "parks for people" and home gardens where people can plant and nurture, and create beauty even in a concrete jungle around them.

Urban green space also has an important ecological function in its own right. In a city, the presence of open wooded areas, scrubs, urban wetlands, horticulture and agricultural areas represent a mosaic of ecosystems. These complex ecosystems contribute to the bio-geo-chemical cycles in an urban environment.

An urban landscape is as much a home to wildlife as are areas such as forests or environment of wilderness. In India even in a typical metropolitan scenario, it is easy to spot animals and plants, which have over time learnt to live and thrive in the midst of human activities. A great variety of birds and insects, from pigeons to geckos to cockroaches, have adapted to an urban ecosystem, establishing themselves in a specialized niche/s. There are several such aspects of flora and fauna, which could be observed within the urban and semi-urban limits.

Urban green spaces and Nature Parks act as green lungs of the city and its environs offer interesting options to cater to a variety of interests. They are a haven for walkers, joggers and nature lovers. One can enjoy the sounds of nature and rest one's eyes on some greenery.In many cities these areas also combine the natural with a rich cultural and manmade heritage including historical monuments or traditional meeting spaces.

Urban parks, squares and other public green spaces are immensely important to urban dwellers. They provide an opportunity to spend time out of doors, near their homes or place of work, to connect with the natural world.

Today urban green spaces are rapidly decreasing or deteriorating as they are taken over by encroachments and new developments, threatened by pollution and engulfed by the concrete jungle. These spaces need to be protected and "redeveloped" to not only continue to provide the valuable ecosystem services, but also as invaluable educational opportunities to generate interest and appreciation for wildlife and biodiversity in general.

In order to create an interest and consciousness about the every day interaction between humans and local biodiversity in and around urban or built up environment, particularly for school students, experiences need to be provided to observe, record, and make linkages. Activities need to be designed which allow scope of investigation into urban ecology, wildlife, evolution and adaptation of wildlife in the urban context.

CEE's experiences

Centre for Environment Education (CEE), India has long recognised the value of urban green spaces as a potential opportunity for EE and has undertaken several activities, and developed resources, for people visiting urban parks.

This section briefly describes two of the programmes that aim to achieve this potential. The examples are of initiatives in different parts of India, to develop and use urban green spaces for a variety of environment education (EE) activities.

Cubbon Park

Background

Cubbon Park is an oasis of greenery in the heart of the bustling city of Bangalore in Southern India. This public park, spread over an area of about 100 acres, beautifully combines a rich natural and manmade heritage. Laid out in 1864, the Park has some really old trees and walkways. It also houses a number of impressive public buildings and statues, some dating back to the early 1900's.

Over the last few years the Park is being threatened by increasing pollution, garbage, encroachment of green spaces, and new developments. Although still a popular site for walkers and joggers, the rich educational potential of the Park has not been adequately utilized.

To address this potential, CEE initiated the Cubbon Park Project. The Project included developing a brochure on the Park and involving the young in several activities to help them to explore the park and through it, learn more about the wider environment.

The partners

The partners in this initiative were ING Vysya, a private bank, the Department of Horticulture, Government of Karnataka, and Centre for Environment Education (CEE). ING Vysya Bank, as part of their civic programme, had already installed several dustbins in the Cubbon Park. But they were on the lookout for a more substantial role in the maintenance of the Park. Representatives from both ING Vysya and CEE had a meeting in which it was decided to produce a brochure giving information about both the natural and cultural heritage of the Park. It was felt that any long-term activity for the betterment of the park would be successful only with the involvement of the concerned authorities. Hence, the Department of Horticulture, which maintains the Park, was a natural ally.

Developing the brochure

As the brochure was expected to provide the user information on a wide range of topics, developing it required extensive research. Over a period of 7-8 months, information about the Park was collected from various sources like libraries, through meetings with government officials and experts in different fields. The collected information was compiled to develop the brochure.

The brochure provides a brief history of the Park along with information on the flora and fauna of the Park, the statues and the heritage buildings located within the Park premises. The brochure also has an activity section, which encourages the visitors to the Park to observe and explore the Park better.

The brochure also contains a postcard which invites people to become 'Friends of Cubbon Park'. Interested individuals can fill in their details as mentioned on the postcard and send it to CEE.

The Park as a learning resource

It was felt that closer interaction with people was essential to evoke in them a sense of responsibility towards the park. Hence, several events were held in the Park over a period of one year in which over 600 children from the city participated. These included groups of less privileged children from organizations such as SOS Children's Villages, The Concerned for Working Children etc. These events consisted of activities that were designed such that the creative and observation talents of the children could be brought to the fore and through these get them to appreciate the Park and the wider environment. While some activities taught the children the need to conserve our resources, some others introduced them to concepts like population dynamics and ecological balance.

To make these activities more interesting yet focussed, worksheets were designed and developed by CEE, in English as well as Kannada (the local language).

While education was the aim behind the events, it was carried out through fun and games.

Youth volunteers/facilitators

Through these events, CEE was also able to enlist and train a group of about 30 volunteers from two of the local colleges. During the initial events, colleagues from CEE were present with the volunteers to guide and support them. Eventually, however, the volunteers were able to interact very well with the participants on their own. CEE now has a dedicated group of college students who have expressed their willingness to participate in any such initiative for improving the environment.

It has been hoped that through the brochure and the activities, the young in the city would get involved and eventually form a cadre of dedicated individuals, called 'Friends of Cubbon Park', who would help in the maintenance of the Park.

Experiences and learnings

Throughout the project period, at every step, there were 'learnings'. Some of these will be useful when planning similar programmes.

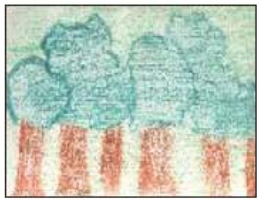
The activities conducted for children seemed to have caught the attention of not only the children, but also the accompanying teachers. Many of the children mentioned that they would do these activities with their friends who had not been able to come for the events. The teachers felt that they could take the ideas back to integrate with their teaching.

The CEE team continued to modify the activities all through the events. For example, the theme given for drawing was changed for each event starting from the launch. Other activities like closing their eyes and conjuring an image of the park, or taking a walk around the park were added prior to drawing. In all the events, there was a cross-section of children from all strata of the society. Handling children from such diverse backgrounds and ensuring that they understood the concept behind the activities while enjoying them too, was an experience in itself.

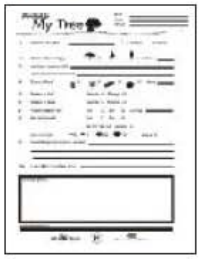
Some of the activities

Drawing

The children were given drawing sheets and asked to sit with their eyes closed and conjure up an image of the park as they could 'hear' it. As is evident from their drawings, this activity helped them in thinking of the park as something more than just trees. Another theme was "Cubbon after 15 years". One group of children were told to draw "What I expected from the Park" or "How I actually found the Park".



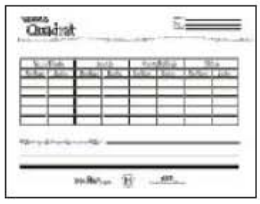
My Tree



Going by the feedback from the children, this activity seemed to be the most popular among them. Taking the 'autograph' of the tree (the bark print), giving it a name of their choice and finding the girth of the tree by holding hands around the tree were some of the most interesting questions in the worksheets provided to them.

Quadrat

Discovering the diversity in a small area was what this activity is all about. The children were asked to note down the names or types of flora and fauna that they can find in a given area. One group of children was particularly excited when they spotted a tiny Rat snake crawling by!



Who am I?

Who Am I?: Cards containing names of the elements / living beings / non-living things were pinned to the back of one child in the group. Everyone in the group, except the child, was showed the card. The child then had to figure out his/her identity by asking suitable questions to the group. This was more like a game than an activity. Through this, children would get an idea of how to ask the right set of questions to arrive at the answer. In the process, they would also learn more about the object.

Quiz

In order to give the children a fair idea about the Park, a short, interactive presentation on Cubbon Park, followed by a quiz on the same, was conducted. Using a brochure as an aid, the children were told about various salient features of the Park, including its natural and man-made heritage. As reflected from the quiz sheets, most of the children had retained at least 70% of the information.

Through these activities, the children not only learnt more about the diversity of the park and its significance, they were also made aware of the need to conserve the park and the role they can play in its conservation.

Ahmedabad Green Partnership Programme

Background

In the semi-arid State of Gujarat in Western India, the Ahmedabad Green Partnership Programme (AGP) was initiated by the Ahmedabad Municipal Corporation (AMC) as an effort towards urban green management in 1997. The project sought to undertake urban forestry in vacant plots in different residential neighbourhoods. Rather than the "greening" being undertaken by the Municipal Corporation it invited Community based organizations (CBOs) and Non-governmental organizations (NGOs) to partner in the effort. The AMC was to provide the land and water supply, and also pay for the fencing, tree plantation and tending, whereas the management and administrative costs were to be borne by the NGO/CBO. The initial process was facilitated by USAID. At the start 27 plots were assigned to 13 CBOs/NGOs for a period of five years.

CEE joined the AGP programme as part of which the Manekbaug Plot was assigned to it. This plot was completely barren, and interspersed with cassia weeds. Moreover the plot was used as a playground by the children from the adjoining residential area, the soil was thus quite hard. All around was traffic, buildings and crowded streets, and pollution and dust.

CEE decided to raise a plantation in the area, with the objective of creating a green space that could be used for a number of educational activities. CEE's main aim was to encourage environment education. Once the plantation was established, the flourishing flora and fauna would enable local children to improve their knowledge and understanding of the environment and the importance of green spaces in urban areas. Ideas for enhancing and sustaining the educational experience included establishing an eco-club, and Nature Discovery Centre which would allow children to engage in various educational and fun activities such as bird watching and nature trails.

Creating an urban forest

A number of tree species, including fruit bearing trees, endemic to the semi-arid conditions of Gujarat were planted in the first few months. A number of medicinal plants were also cultivated. The plantation was raised by making use of only farmland manure and leaf litter. No inorganic manure was made use of at any point of time.

The saplings showed a survival rate of 85% and a number of species already on the site but which had not been able to grow earlier also showed natural regeneration. Today the plot has over 600 plants of around 100 different species. Apart from the greening of the plot, a number of other activities have also been taken up over the five-year contract period. The activities included:

Nursery: A nursery of 10,000 plants was also maintained at the plot during the year 1998 to 1999. The saplings from the nursery were distributed to schools as part of a plantation programme held with school eco- clubs.

School Programmes: About 1500 saplings per school for five schools were distributed to the students in one month alone as part of a plantation programme. The plantation was done partly in the schools, and partly on the plot. The plantation programme took place on the eve of India's Independence Day. As part of this programme the students were also to monitor the growth of their saplings for a period of one year at an interval of 15 days.

Workshops were organized for CEE's Club of Youth Working for Environment (CYWEN). Workshops emphasized the importance of green spaces in an urban environment. These were followed by a plantation programme on the site. Workshops are also conducted for school and college students, emphasizing the importance of green spaces in urban areas.

Activities for school children included

Identification of insects, identification of birds and bird calls, knowing about soil, caring for trees, building a green house, growing vegetables, how to make manure.

Today walking through the gates of the Plot one enters a strikingly different world. A sense of calm and serenity mingles with the fresh earthy scent lingering amongst the foliage. A leafy path winds through dappling sunlight, offering an invitation to explore the flora and fauna. Wooden benches ideally located provide an opportunity to sit down to enjoy the sounds of twittering birds and observe the playful squirrels. Several signages contain informative facts about trees and plants. Wrought-iron animal sculptures explain a food chain—from the insect to the peacock. The Manekbaug Plot No. 21/601 has grown along with its trees into the Manekbaug Nature Education and Forestry Programme.

Biography

Mamata Pandya has been with CEE since 1985. She is involved in developing EE material, teacher training, and children's workshops. She has also developed materials for SACEP (South Asia Cooperative Environment Programme) and UNEP (United Nations Environment Programme) She currently coordinates the Children's Media Unit, and Zoo Education programmes at CEE.

Meena Nareshwar is Programme Officer/Scientist, working for the Centre for Environment Education (CEE), India for more than ten years now. CEE is a national institution established in 1984, supported by the Ministry of Environment and Forests, Government of India. The main aim of CEE is to create environmental awareness among children, youth, decision makers and general community. Meena's work involves developing Education and Interpretation programmes for zoos, botanical gardens, and natural history museums.

"Adding Value" to an Urban Green Space

A large number of components can be planned for enhancing education and interpretation in urban green spaces and for making the visit of people to such areas exciting, enriching and a valuable experience.

While planning it is equally important to be sensitive to and include facilities for differently-abled visitors – e.g. ramps, railings, "sound posts" and "touch and feel exhibits. These would add further value, to encompass a larger audience.

On-site Interpretation through Signages including entrance sign and map of the Park, along nature trails, and at key points in the Park.

Park Ethics Siganges to sensitize visitors not only to unique features of the site, but also their own roles and responsibilities as a visitor.

Interpretation/Resource Centre can help to orient and create interest in visitors about nature and wildlife, biodiversity and its importance, role of urban parks, historical and cultural aspects and need for conserving and protecting such areas.

Nature trails within the Park with relevant interpretation (through signages and other techniques) on plants, animals, history, culture and other interesting aspects about nature and biodiversity.

Children's Play Area: Many interactive and interesting games can be developed for children, using the natural resources of the park as the teaching and learning opportunities. These games and activities could be integrated with the school curriculum.
Publications for the varied target audiences visiting the park. Publications could range from checklist of birds, insects, butterflies, small mammals and reptiles to worksheets, activity manuals and reference books.

Outreach and Extension Activities: Large number of school visits can be organized to these parks. College groups can also use these parks for study and monitoring purposes. Nature clubs can be formed and their activities can be conducted in the Park. Several events and important days like the Earth day, World Environment day, Wildlife week, etc can be celebrated in the Park.

Connecting with Teens: Strategies for Engaging Youth in Botanic Gardens

Sharon A. Myrie& Elyssa Arnone

Brooklyn Botanic Garden & Brooklyn Academy of Science and the Environment(BASE)

Like most gardens throughout the world today, Brooklyn Botanic Garden (BBG) has been challenged in our ability to engage older youth to fully participate in activities at our Garden. The time demands placed on young people have become increasingly present in school and during after school hours. In New York City, mandatory requirements have been established in high schools that have significantly reduced the amount of flexible time for teachers and students to enjoy outside activities to enhance a classroom experience such as visiting a local botanic garden or exploring an art museum. For example, students in high school are now required to take a series of state standardized tests (Regents examinations) in order to qualify for graduation. "Teaching to the test" has become a common criticism launched against public school systems by educators who recognize that students learn in different ways and can be labeled achievers beyond simply the scores they receive on Regents examinations. Clearly, new approaches must be explored by botanic gardens to reach this shrinking audience.

In recent years, BBG underwent an institution-wide master planning and development process. In 2002, an Education Strategic Plan, complementing the goals of the Garden's Master Plan, resulted in the development of a "road map" to help us assess, strengthen and re-organize existing education programs, and develop new ones. Despite the challenging economic climate (a year after September 11, 2001), the Education Strategic Plan enabled us to more effectively deliver our ongoing programs, and to focus on strengthening specific areas within the department. A common theme that emerged out of the strategic process through focus groups among students, parents and teachers indicated that BBG was well-known and respected for its work with elementary and middle-school age children (ages 5 through 12) but needed to improve its programming targeting older youth (ages 13 through 18).

With this "road-map" in hand we embarked on a journey that began to open up doors of opportunities for us to address these concerns specifically working with the older youth. Within the last three years, two significant initiatives were created that completely re-focused our way of delivering programming and placed us in the forefront of how botanic gardens in the United States are working with youth today. This paper will explore these two initiatives, the creation of **Brooklyn Academy of Science and the Environment (BASE)**, a small public high school with a science and environmental focus; and the **Garden Apprentice Program (GAP)**, a newly restructured internship program with the goal of introducing urban youth to careers in science, horticulture, education and public service.

Brooklyn Academy of Science and the Environment (BASE)

Soon after the creation of the Education Strategic Plan, BBG was invited by the New York City Department of Education (DOE) to participate in a growing movement spearheaded by the New Century High School Initiative to serve as a lead partner in the creation of a small school. Recognizing our desire to work more closely with high school students and develop stronger linkages in our local community we immediately began to think of ways to build a school

curriculum from the ground up that would use the Garden as its "living laboratory". BBG joined forces with **Prospect Park Alliance** (the Park), a public/private partnership that oversees the programming and restoration of a popular 585-acre city park; **New Visions for Public Schools**, one of New York City's leading educational reform organizations; and **DOE,** in creating **BASE**, Brooklyn's first environmental-focused public high school.

BASE is located directly across the street from BBG, housed in the former **Prospect Heights High School,** a large, underperforming public high school that was phased-out this past June and transformed into four separate small schools, one of which is our school. In its earlier years, Prospect Heights High School enrolled up to 2,000 students with one teacher to approximately 30-35 students per class. The average attendance rate was 77%, the school had a 30.5% drop-out rate and less than 30 % of the students graduated on time. BBG was determined to work with its partners to create a new model school for the youth of our community – one infused with strong academic leadership, community support, parent involvement and meaningful teacher-student relationships. For nearly nine months, BBG co-lead a planning team of 23 participants consisting of students, parents, professors, teachers, and school administrators in developing a school that offered a rigorous education and embraced an inquiry-based learning philosophy. We designed a three-part campus (the school building, BBG and Prospect Park) breaking down traditional classroom barriers and opening the door to resources that would never be available to most high schools.

Over the past three years BASE has developed into a full fledged public high school. In the fall, a new class will be added that will complete the school's phase-in period and we will be fully enrolled at a capacity of approximately 450 students serving grades 9-12. BASE draws students from throughout the city, but serves predominantly its immediate low-income community. The student body of BASE reflects the surrounding neighborhoods: 24% of the students are recent immigrants and 83% are African-American or Caribbean-American. At BASE over 82% of the students are eligible for the free or reduced lunch program based on their family income.

As with most public high schools, BASE has state mandated requirements for graduation that it must meet and follows a typical New York City public school curriculum. However, through its unique partnership, the BASE curriculum includes a strong hands-on component through its science field studies and research in the Park and Garden. While staff throughout BBG is involved with the school on a regular basis, BBG has dedicated two full-time staff members to support the school: Elyssa Arnone works directly with the science teachers in designing and delivering a unique field studies course that enhances the life science curriculum, particularly focusing on teaching the scientific method. Robert Wanvestraut connects the Garden's Science Department with BASE students, introducing them to real-world science research skills and methods. An example of their research project includes students working with scientists to create a DNA database of BBG's living plant collection. Students are conducting all aspects of this research: collecting and mounting specimens, drying leaf tissue samples and extracting DNA. BBG coordinates the judging and serves as a host site for a science fair that highlights scientific research projects that have been completed over the academic year. In addition, BBG provides funding to support a full-time Community Director who works to develop relationships and resources with community organizations that yield internship placements at science and environmental organizations based throughout New York City.

As lead partner, BBG was given a formal leadership role in all aspects of developing the new school, from designing a schedule and curriculum that maximized the time that teachers and students spend at the Garden, to overseeing school governance issues. BASE enables the Garden to develop an on-going, long-term relationship with high school students and teachers, increasing

the number of high school students and teachers involved in our initiatives by ten-fold, and introducing BASE parents and families to the Garden. Each year family members are provided a frequent visitor pass that allows them to visit the Garden for free and we offer workshops for families. Students see BBG as a true extension of their school and rarely identify us as a separate entity.

In essence, serving as a community partner in creating BASE has transformed BBG from a provider of informal, supplemental educational services into a full-fledged, formal educational partner with the New York City Department of Education. In just three years, we are already seeing positive results emerge. Each year over 95% of our students have passed the state biology (Regents) examination, which is well above the city average. BASE has been recognized as one of the New Century High School Initiatives model schools possessing one of the strongest partnerships, and was one of a handful of schools "showcased" to the President of The Bill and Melinda Gates Foundation (a major funder for the Initiative) during their New York City visit in February 2004.

This type of deep partnership with a high school is quite unique and may be difficult to replicate at other botanic gardens, but we believe that components within this model can be adapted, especially the field studies that get students out of the classroom and into the Garden. Embarking on this type of initiative is definitely not for the weak-hearted. It is incredibly hard work and requires constant attention and resources. Gardens might want to consider a more attainable approach to engaging middle and high school age youth following the example of our second initiative, **Garden Apprentice Program (GAP).**

Garden Apprentice Program (GAP)

About the same time that we embarked upon developing BASE, we were introduced to educators from the Audubon Zoo in New Orleans, Louisiana – renowned for their youth development programs. The Garden worked with the Audubon Zoo to transfer knowledge and experience from the Zoo's Junior Keeper Program in order to restructure the Garden's Junior Instructor Program, at the time our signature internship program for young people ages 15 to 18. A major lesson learned from the Zoo's program was to feel confident in broadening the age range served. In the spring of 2004, BBG launched a 4-tiered **Garden Apprentice Program** -- appropriately named "GAP" – in recognition of the age range which is often left out of youth programming (13-15 year olds).

The model of the Zoo's Junior Keeper Program was well suited to the needs of BBG's internship programming. Our strategic planning process identified the challenge of creating a more focused 'career ladder' that could start to connect the Garden's internship programming for adolescents, and strengthen 'real-life' work skills. This is important as in order to move into productive jobs and build fulfilling relationships, young people need continuous exposure to positive experiences and abundant opportunities to refine life skills.

Today, GAP provides youth with opportunities for personal growth and career development. The four-tier program includes training and volunteer placements with increasing levels of responsibility focused on gardening, environmental issues, science, leadership, and career skills. Each tier builds on what was learned the year before. In Tier I, 8th and 9th grade (ages 13 – 15) Discovery Guides work at Discovery Carts, (mobile themed learning stations that provide the public with information about plants and science topics). Tier 2, the Garden Corps, includes both returning and new 9th and 10th graders (ages 14 – 16), who are placed in our Education, Science,

Horticulture or Library departments. In Tier 3, 10th, 11th and 12th grade (ages 15 – 18) Junior Apprentices assist our Children's Garden staff with gardening, teaching, and managing student groups. In Tier 4, 11th and 12th grade Senior Apprentices lead groups in the Children's Garden, supervise and assist Discovery Guides and the Garden Corps, and mentor Junior Apprentices. Junior and Senior Apprentices receive modest stipends. There is a one-time tuition fee at the beginning of the first tier to mark the seriousness of the program and to help defer the costs of uniforms, supplies, and training. Scholarships are available to those who cannot afford the fee.

Recruitment for GAP is a competitive and selective process designed to attract more serious and enthusiastic students. Students must complete a rigorous application and present themselves in an interview. Parent involvement is also important to the success of the program. Parents are required to sign a commitment statement indicating that they will support their child in this endeavor. Special events like Family Day to involve parents in their child's internship are built into the program. Each intern must make at least a one year commitment. The targeted participants for GAP are Brooklyn public middle and high school students, including those at BASE. We currently have about 55 interns in the program. When fully operational, GAP will offer 75 internships to middle/high school students – a 25% increase over our former program. With their distinctive "blue shirts" the GAP youth have rapidly become a favorite fixture in the Garden for our visitors as well as our staff. As the program grows, our staff is increasingly enthusiastic about the possibility of obtaining a GAP intern.

In a city that has fewer acres of green space per capita than any other American city, offering a chance for urban youth to learn about careers in the environmental field and plant sciences becomes increasingly important, particularly for students of color who represent just a fraction in the professional field. GAP is an attempt to reach students at an earlier age so that they can develop a better understanding of career choices and hopefully will encourage them to pursue careers in these fields.

Presenter Biographies:

Sharon A. Myrie, Vice President of Education at Brooklyn Botanic Garden, manages educational programs serving over 150,000 children, as well as adult education and community outreach programs through a wide range of initiatives.

Elyssa Arnone, the Brooklyn Academy of Science and the Environment Program Manager at Brooklyn Botanic Garden, has a degree in Plant Biology from Ohio University. Elyssa has been an educator for over ten years.

Back to the Future

Leigh Sheridan Morris

Royal Botanic Garden Edinburgh

For over a hundred years the Royal Botanic Garden Edinburgh (RBGE) offered their 3-year 'Diploma in Horticulture, Edinburgh' course, which was very similar to that still offered by Kew today. In 1995 this course ended and was replaced by a 2-year, mainly theory based, Higher National Diploma (HND) programme in 'Horticulture with Plantsmanship' delivered for one year by the Scottish Agricultural College in Ayr and the other year in Edinburgh, predominantly at RBGE.

The HND at RBGE, however, has gone through a huge period of change in the last 2-years (e.g. with both years of the course moving to Edinburgh and the re-introduction of garden based work experience and practical based projects for the students) and a full BSc in Horticulture with Plantsmanship is also to be offered from this September at the Garden. This talk will outline these developments and RBGE's vision for delivering an internationally recognised, professional, practically based, higher education horticultural qualification, within a botanic garden setting…… and the challenges this brings!

Project Green Reach at Brooklyn Botanic Garden: A case study of the summer program

Susan Conlon Morgan[1] & Dr. Susan L. Hamilton[2]

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Abstract

This study examined Project Green Reach (PGR), one program of the Children's Education Program at Brooklyn Botanic Garden (BBG). Located in Brooklyn, New York, USA, BBG is a public garden that has served as a model program for garden-based youth education since 1914. PGR utilizes both the indoor classroom and outdoor laboratory to engage K-8 students and teachers at Brooklyn's Title I schools in informal learning about science. Every year, PGR instructors select a small group of students into the summer program where they work in teams on garden and science projects at BBG. A case study was conducted to document PGR's summer program as a potential model for informal science youth education and to investigate the effects of PGR on inner city youth. Field observations of PGR's summer program participants and collection of program documents were conducted during the 2004 Summer Program. In 2005, phone interviews were conducted with four adult PGR Summer Program alumni and one former staff member who discussed their experiences while participating in the program and described the meaning of PGR in their lives. From the data collected and triangulated through document review, observations, and interviews, seven themes emerged: (1) PGR participants come from challenging home and school environments, (2) PGR developed academic and interdisciplinary skills, (3) Participation increased understanding of science concepts and developed gardening skills, (4) PGR fostered environmental awareness, (5) PGR supported social development and personal growth, (6) PGR was a positive life experience, and (7) BBG is culturally significant to the participants' community. From the results, it is concluded that PGR has had an impact on participants' lives, showing that PGR had positive influence on their views towards BBG, gardening, and science.

Paper text

Brooklyn Botanic Garden (BBG) developed a unique gardening program which targets disadvantaged youth and eliminates barriers, including funding and transportation, that typically prevent them from participating in such programs. Project Green Reach (PGR) is a specially-funded outreach program that utilizes hands-on, inquiry-based learning to promote science education and environmental awareness. It has been serving K-8 students and teachers at Brooklyn's Title I schools since 1990. Every year, PGR instructors select a small group of students into the summer program where they work in teams on garden and science projects at BBG.

The purpose of this case study was to investigate the long-term impacts of PGR's Summer Program (PGRSP) on its participants and to document it as a youth-gardening instructional model for public gardens. Data collection methods for this study included non-participatory field observations of 2004 PGRSP participants, collection and analysis of program documents and

records, and oral interviews of PGRSP alumni, former staff, and 2004 staff.

Table 1. Name, gender, age, cultural background, year participated in PGR, and education characteristics of alumni interview participants.

Name	Gender	Age (years)	Cultural Background	Year (& Age) participated	Education
Sasha*	Female	24	South American	1990 (age 9)	Currently attending college
Deborah	Female	24	African American	1990 (age 9)	Bachelors degree
Richard*	Male	22	Caribbean American	1991 (age 9)	Bachelors degree
Mary**	Female	22	Haitian American	1993 (age 10)	Bachelors degree
Sally	Female	---	Former PGR Instructor	1989-2000	Bachelors degree

* First generation child within family unit; Parents non-native to U. S.
* * Born in another country.

Seven major themes emerged from the data about PGRSP and its participants.

PGRSP participants come from challenging home and school environments. Handwritten notes from a PGRSP instructor described several points of concern for the welfare of one child who participated in the early years of the program. The child reported not having anything to eat for breakfast most days and sleeping on comforters on the floor because her bed was broken. Field observations showed that although most of the children were active and friendly, some appeared more introverted and troubled. Alumni interviewees described growing up in or having friends who lived in housing projects and living in a neighborhood or going to school where there was drug use and violence. These examples illustrate how BBG reaches out to inner-city children, a typically underserved population in its community.

PGRSP participants developed academic and interdisciplinary skills through program participation. Not only did participants develop science and reasoning skills, but through plant-based education, they developed other skills, including writing, public speaking, artistic, and cooking. Observations found participants displayed an exhibition of their acrostic poetry, haiku, and art in their classroom. They sampled homemade pickles and jam they had made using freshly-harvested fruits and vegetables from the garden. Worksheets on family trees encouraged students to celebrate their families' heritage and learn about the geography of their country of origin. Photographs showed children writing in journals and working on arts-and-crafts projects using plant material. One alumna, Deborah, recounted her experience of journal-writing and public speaking in PGRSP and how she drew upon her experiences when she was in college. Alumnus Richard recalled visiting BBG with his mother to attend cultural events, including an African music festival. He credited BBG with bridging his love for music into his life. The use of gardening activities contributing to interdisciplinary learning is not new. Other studies have found that through gardening activities, children can learn different skills, such as art, math, history, writing, and nutrition (Lewis 2005; DeMarco, et al. 1999; Skelly & Zajicek 1998).

PGRSP participants increased their understanding of science concepts and developed gardening skills. Participants have opportunities to become young gardeners and scientists. A handwritten note from a mother whose son had participated in PGRSP expressed not only gratitude to the BBG staff for her son's opportunity to participate in the program but acknowledged the science concepts and gardening skills he learned: "[My son] really enjoy taking part in the program. He learn and understand a lots about vegetable, plant, leaves, stem, seeds, fruit, and flower. He came home and share the knowledge with the rest of the family about his day. He gain lots of experience at the garden. He recognize and value the work, it take in

harvest an garden. …It is a summer we will always remenable [remember].” Lesson plans showed the science and gardening concepts covered in class, including garden etiquette, plant parts, photosynthesis, and other botany and garden-related activities. Observations found participants working in the Children’s Garden and doing a scavenger hunt for plants and nature-related objects throughout the BBG grounds. The older children went to research facilities across the street from BBG where they dressed in white labcoats and worked on science experiments, making observations and employing the use of the scientific method. All alumni interviewees stated that although they did not currently garden, they felt skilled with the knowledge and ability to garden because of PGR and planned to garden in the future. These examples support anecdotal evidence that as a result of participation in PGR, children evolved into young science investigators and gardeners. This finding is similar to Blandford (2002) and Tims (2003) who found that children who participated in a public garden’s children’s gardening program learned about science and nature.

PGRSP fostered environmental awareness and appreciation in its participants. Hands-on, first-person experiences exploring BBG contributed to a better environmental awareness and appreciation. When asked how the program had meaning for him, Richard stated: “I enjoyed the program. It did help me grow I believe…probably moreso with my consciousness and with the things I think about and my appreciation for nature because…I do respect nature. ...And so…it’s (PGR) changed my consciousness.” A foundation report described one participant as a boy “who dreams of becoming a Marine Biologist…he relished the opportunity to participate in the PGR program.” Observations of 2004 participants found they were aware of their outdoor environment. Children were engaged in pulling weeds, examining insects, and playing in the dirt. They enjoyed harvesting cucumbers from their garden plots and tasting grapes from a nearby grapevine. Each alumni recalled observing wildlife at BBG, including fish and frogs in the Japanese Garden and flies in the Children’s Garden. These findings are similar to research which found that children who had gardening experiences while at school demonstrated an increased positive attitude towards the environment (Waliczek & Zajicek 1999; Skelly & Zajicek 1998).

PGRSP participants grew in their social development. It is implied from the findings that social-skills development was a significant aspect of learning in PGRSP. One class worksheet described staff skits held on the first day of the summer program on the “3 R’s: Respect, Responsibility, and Reliability.” These skits were followed by classroom discussion on the meaning of respect, responsibility, and reliability and how it relates to the children in the garden and their daily lives. Deborah recalled a lesson in treating plants like you should people while being taught how to tend to her garden plot. Each alumni described meeting other children as an important aspect of the program. They appreciated the opportunity to make new friends. Field observations found children working with partners on their garden plots. Older children who had more gardening experience mentored younger, more inexperienced children. An instructor’s evaluation sheet reviewing PGRSP described the value of having a small student-teacher ratio as important in working together and strengthening interpersonal relationships. This data is similar to other research which has shown how learning about plants can be adapted into life lessons about interacting with others, building self-esteem, and respecting others (Waliczek, et al. 2001; Finch 1995; Pentz & Straus 1998).

PGRSP was a positive life experience for program participants. Typed notes by a PGR staffperson described a mother’s account of how PGR had a positive effect on her daughter’s life: “…The mother said the program turned around her daughter’s life; she now loves science; whereas she had been doing very poorly in science, she now is top in her class, takes care of the principal’s plants and helps the teacher with plant information; she loves science.” Observations found participants picking vegetables they had grown in their own garden plot and proudly

showing their vegetables to each other and their instructors. This overall positive experience remained with the participants to adulthood. Alumni enthusiastically described PGRSP using the terms, "fun," "productive," "meaningful," or a "great experience." They recalled proudly showing their garden plots and artwork to their parents at Graduation Day. Each of the alumni participants indicated they would recommend and, in the case of alumna Sasha, have already recommended PGR to others in their community because of their positive experience. They also indicated they would take their own children to BBG. Former PGR staff member Sally described a discussion with a participant's mother: "It was this program that had kept her son off the streets and out of the black jackets and out of the expensive cars that she perceived that drugs would have brought to him." Sally added: "There were numbers of parents that told us that they could see such a difference in their children, the way they were able to get along with the people after the summer, because they had been taught honesty. They had been taught learning how to get along, learning how to understand people, learning how to use other people's things and not keep them but give them back. They felt they had received many lessons that are very difficult to teach in a regular public school system, and they felt that was very good for their children in learning to get along at home and learning to get along in the workplace." This finding is similar to other studies which have found that children from urban and at-risk environments respond positively to gardening activities (Rahm 2002; Tims 2003; Blandford 2002; Pentz & Straus 1998; Finch 1995).

BBG is culturally significant to the PGRSP participants' community. Observations found that participants were culturally diverse. Participants' diversity reflected the diversity of the Brooklyn community. This was observed by the researcher's daily walks through the surrounding neighborhoods with wealthy residents and nice homes on one border of BBG and a lower economic community on the other. Sally stated that "the location of BBG within the community was a major part of the success of PGR." When selecting PGRSP participants, the staff tried to select a diverse group of students since diversity was a primary focus of the program. In a foundation report, it was stated that "since the program was founded, it has consistently served a high number of students from families that have recently immigrated to the United States. The 2000 Summer Program had participants from eight different countries." These findings describe how a public garden can be a cultural institution in a community.

Conclusion

This study shows that PGRSP serves as a positive experience for youth who come from challenging home and school environments, helping them to further develop their science, gardening, interdisciplinary, and social skills. Findings also indicate that PGR is reaching its goals to work with Brooklyn's Title I schoolteachers and children to educate students about science concepts through plant-based education and foster a relationship between this traditionally underserved population and BBG. The cultural significance of BBG to the participants' Brooklyn community and how this program celebrates the cultural diversity of its participants are important factors to the success of PGR.

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Biography

Susan Conlon Morgan completed graduate studies in public horticulture at the University of Tennessee. She is the Assistant Gardening Editor for Home and Garden Television's website, www.hgtv.com. Completed study: http://etd.utk.edu/2005/ConlonSusan.pdf.

Recycling plastic bottles as mini greenhouses for plant propagation

Wangmo Moitra

Royal Botanic Garden, Serbithang, Bhutan

How to make a mini glass house

Things that we require for making a mini glass house

Cut the plastic bottle and remove the piece of the middle portion as shown in the diagram

Different ways of cutting the plastic bottle

The top & the bottom portion of the plastic bottle has to fit tightly as shown in the diagram

Open the bottle and fill with compost by ½.

Dip the cuttings into the rooting hormone

Plant the cuttings with the help of dipper as illustrated in the diagram

Pour some water to moist the soil to enhance rooting.

Finally the construction of the mini glass house is complete with plant/ cutting with the mini glass house.

Biography

Ms.Wangmo Moitra, Biodiversity conservation technician. I have been working at Royal Botanical Garden as Environmental Education staff. My day-to-day assignments include interpretation of the Garden according to theme, plant propagation and facilitate school environmental education training workshops and meetings etc. Above all, I have gained skills and experiences for the last four years working in the garden and its conservation role.

Towards sustainable production and consumption: An example of educational workshop

Simon Meriaux

Department of Botanical and Zoological Gardens, National Natural History Museum, Paris, France

In the framework of these activities, the Department of Botanical and Zoological gardens of the National Natural History Museum of Paris offers children and adults various guided tours and workshops which deal with plants, biodiversity and gardening. It seems today very relevant to use botanical gardens as an example to tackle sustainable development issues.

In this paper I would like to present a new workshop for secondary school children. The goals of this workshop are to understand the sustainable development concept, to study the different actors linked to the production of tomatoes, to identify the sources of pollution at all stages and think about means to limit these sources of pollution. In this text we are going to take a look at the main ideas of the workshop "towards sustainable production and consumption". This workshop is ideal to introduce the problems involved in sustainable development to school children.

From production to consumption

The vegetable garden of the Jardin des Plantes of Paris is a good starting point for this workshop. Here children can speak about tomatoes, which are the "fruits" that children eat very frequently. Tomato is an example of vegetable product which can have some impacts to the Environment. Children are lead to understand that all human activities impact the environment more or less. Nowadays the situation can be serious: the biosphere is subject to major problems of pollution or destruction of habitats which bring about global climate change or the extinction of animal or plant species. As a consequence of this situation different concepts such as "sustainable development" or "ecocitizenship" has appeared in the medias in the last ten years. In other words it can be said that the aim of these new concepts is to reconcile the human activities of production and consumption with a better use of natural resources in order to constitute the development of "future generations".

The tomatoes of the vegetable garden of the Jardin des Plantes

To better understand the issues of sustainable development it is useful to first identify the

different players involved in the production and consumption of goods. The production of tomatoes is a very good example, which can be used to identify these players – from the first stage of production to the final stage of consumption.

This production-consumption process can be broken down into different stages:

- **Farmers** are responsible for cultivating tomatoes. The intentions of farmers is to product large quantities of high-quality "fruits". Their first task is to encourage plant growth (thanks to watering and fertilizing), and stop weed and insect development (through the use of pesticides). Tomatoes can be grown outdoors, but in France, 90% of the tomatoes produced comes from greenhouses, where the plants are heated and provided with extra artificial light.
- **Packing companies** have to package tomatoes to ensure their preservation throughout their transportation. Vegetables are stored in refrigerated units and wrapped in plastic or put in polystyrene boxes.
- **The carriers** are responsible for their transport from the packing houses to the places of sale. Tomatoes can be transported by plane, by rail or by land. They can be transported over large distances ; the tomatoes consumed in France come often from Morocco, Italy or Spain.
- **Resellers** aim to sell large quantities of vegetables to consumers. Tomatoes are sold in grocery stores as well as in hypermarkets and are presented in different ways accordingly: either in bulk, or small pallets or wrapped in plastic for the smaller quantities sold. In France most consumers buy tomatoes from hypermarkets.
- **The consumer** plays the final role: he has to choose from the various outlets where he will buy his tomatoes. In this respect it can be said that consuming is in relation to our needs and possibilities.

Various sources of pollution

Once the children have identified the different players of the tomato production process and have understood their roles, it seems pertinent to identify the different sources of pollution which intervene at each of the various stages of production. Children are lead to understand that pollution problems are widespread and that all the players are concerned.

In order to increase production, **farmers** use several different fertilizers. On the one hand, some of these fertilizers infiltrate through the water tables (or rivers) and therefore deteriorate the quality of water. On the other hand the nitrogenous fertilizers cause the proliferation of several types of seaweed (eutrophication, "greentides").

To prevent weed and insect development breeders use pesticides which have dramatic effects on the environment. Indeed, a part of these pesticides are released into the atmosphere and into river and can have harmful consequences on both human health and plant and animal development. Many butterfly, bird, fish or plant species disappear due to the use of pesticides in farming.

Another source of pollution is the use of hydrocarbons: the synthesis of chemicals (fertilizers and pesticides) and greenhouse heating cause a considerable waste of energy. For example in Europe, to grow a kilogram of lettuce in winter requires a kilogram of hydrocarbons.

Moreover, the use of plastics and polystyrenes **to package** vegetables and fruits results in a high hydrocarbon combustion. This combustion emits different greenhouse gases (GHG) such as carbon dioxide (CO2)… Vegetable preservation in refrigerated units consume large quantities of energy.

In European countries, **conveyance** is a main source of greenhouse gases emission. The accumulation of GHG in the atmosphere leads to a global climate change which will have dramatic consequences on both the environment and on the health of humans.

In western countries, hypermarkets are the primary **selling** points for consumers. This kind of outlet is generally constructed with non-renewable materials such as metal or plastic. Hypermarkets use a lot of land space and have consequences on landscapes.

Finally **consumption** is a highly polluting activity which concerns everyone and above all produces enormous quantities of kitchen waste: most packaging materials cannot be reused and are often thrown out. Only some is recyclable. Last but not least, refrigerators are the highest consumers of energy among all the other major appliances in a household.

Finding solutions

In spite of the numerous sources of pollution, we should keep in mind that other solutions exist! What is at the core of sustainable development issues is the ability for a citizen to think about their environmental responsibilities. And thus adapt their behaviour in order to better respect the environment.

To lead children to think about solutions to reduce pollution we propose to them a role-play game: the group is divided into five different kinds of actors (growers, packers, carriers, resellers and consumers). Each group has to try to fulfil his task resulting in the least amount of pollution possible. To help them in their mission the children will receive guidelines which suggest possibilities and force them to think. For example, growers are asked how to help plants grow: should nitrogenous fertilizers be chosen or organic fertilizers or should the land be allowed to fallow for months between growing seasons? After a ten minute time span each group is asked to present (with the help of the educator) the different solutions they have found.

Some farmers use different farming methods which are more respectful for the environment. In Europe there is an important quantity of farmers who farm using organic methods to produce vegetables, fruit, and different grain without the use of chemical fertilizers and pesticides. Scientific surveys (for example Hole D.G. *et al*. 2005) have shown that organic farming has very often a very positive effect on numerous plans, butterflies and birds.

The question of packaging has to be related to the transport issue: indeed, goods have to be properly packaged before being transported over great distances. The fact is that better stock management and transportation means can reduce the use of refrigerated units. And, above all, in most cases, renewable resources like wood or cardboard can be substituted for the unrenewable ones such as polystyrenes, or plastics.

Another way to tackle sustainable development issues is to deal with transportation issues. It is essential to reduce transportation pollution if we want to fight against greenhouse gas effects. Boats, barges and rains can be substituted for cargo planes or trucks. Rail and riverboat transportation are under exploited. With better stock management these kinds of transport are much less expensive that airfreight or land transportation means.

The materials used to construct buildings can have a dramatic impact on the environment. It is necessary to think about the different materials that can be used before construction in order to save energy. For example it is better to use renewable materials such as wood. Today more and

more hypermarkets have stopped offering plastic bags and have encouraged consumers to bring their own transportation means.

Alternatives in terms of shopping are determining as well. The consumer can choose to purchase goods which are less harmful to the environment: for example, organic farmed products (products which are marked "organically grown", or "organic farming"). The countries of origin where the goods are produced may be an indication of their pollution level: in France a tomato coming from Morroco requires more transportation time than one coming from a neighbouring country. Taking this into account it is more reasonable to choose the latter. In Europe, cultivating tomatoes during the winter requires higher quantities of energy than those produced in spring or during the summer. It is fundamental to chose to eat seasonal vegetables – it is better for human consumption and for the environment. If selective sorting is a good thing, not buying packaged goods is better: it would be better to choose paper packaged vegetables. Although it is impossible to live without refrigerators, it is possible to choose a refrigerator which consumes less energy or whose maintenance can be optimised.

To conclude, it can be said that children will have learned through this workshop a better knowledge of the player's roles. If it is fundamental that pupils grasp the various sources of pollution it is even more important that they are lead to think about how to reduce pollution in their daily life. Like the consumer, the pupil is lead to understand that he is able to do something to support environmental issues.

In this workshop the educator has to speak using simple terms. Some concepts require more time for explanation than others – especially for very young children. The educator can revert to drawings, pictures or even objects (different packaging methods) which can better illustrate the different production stages, equipment used or selling processes.

By using a botanical garden in this workshop it may bring about other educational activities on biodiversity (it would be interesting to take a look at the numerous animal and plant species which have disappeared through pesticide use in modern farming methods compared to organic farming methods). In a nutshell, all activities involving humans have an impact on our environment and can be studied through such workshops.

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Connecting plants, people and culture: Three approaches

Steve Meredith

Botanic Gardens of Adelaide, Australia

Plants have diverse and intriguing stories that provide insights into people, cultures and the environment. However, in botanic gardens we have a relatively short time to get our messages across to the many school students who visit our sites annually. In Australia, we also deal with increasingly sophisticated young people who live in a fast paced world saturated with different media that compete for their attention and interest. Our young people grow up in a rapidly changing world, one in which information communication technology continues to shape their everyday lives both socially and educationally. Unlike generations before them they face an ever increasing dislocation from the natural world that nurtures them.

In such an environment learning has to be designed creatively to deliver programs that have educational integrity yet resonate with young people above the background chatter of their increasingly media-rich world. Garden educators face the challenge of harnessing and presenting their stories and messages in ways that make for engaging and intriguing learning but maintain their educational validity and curriculum relevance. This paper will outline three different approaches we are using in our attempt to meet this challenge:

- **Listening for Learning** - a project to investigate the use of MP3 players to deliver learning through entertaining scenarios, sound effects, characters and song.
- **Plants and People of China** – a website that uses plants to integrate the teaching of language, culture and environment, both on the web and back in the classroom.
- **Quiz Trails** – a way of embedding learning within large scale events.

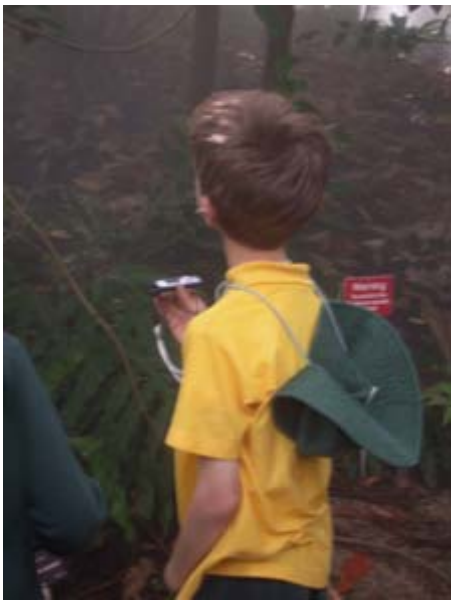
Listening for learning

Rapid advances in MP3 audio technology and the continued fall in prices now make solid state MP3 players economically feasible for education based audio tours in museums and similar educational institutions like botanic gardens.

In the past we used a relatively cumbersome, hired cassette system for audio interpretation. It was popular and successful but limited by the inflexible nature of the technology and the expense. Eventually the machines wore out and prohibitive costs prevented their replacement, much to the disappointment of schools who regularly used the service and still request it today some five years on. This initial experience got us thinking about alternative ways of developing our own

sound tours in house. The rise and uptake of MP3 players has now opened up many flexible, inexpensive and exciting possibilities in this area.

The spectacular rainforest display in our conservatory was chosen as the ideal place to introduce a new MP3 rainforest adventure tour. The realism of our conservatory setting provides an powerful vehicle for learning about the beauty, diversity and complexity of rainforest. The award winning architecture of the building with a single entrance and winding, dual-level viewing paths immediately immerses visitors in a rainforest simulation that lends itself well to both the practical and visual elements of audio interpretation.



We developed a script rich in sounds, music, characters and invitations to learn through discovery rather than an endless monologue of facts. This is now easy to do because of inexpensive sound engineering software that is able to produce relatively high quality, professional sound recordings on home computers. The software allowed for an iterative development process and for content to be easily changed at any time. This is particularly important for living displays which can change regularly.

The recording opportunities offered by the digital age enabled us to move away from the more traditional audio tour monologue into the realm of a dynamic fusion of entertainment and information. This was facilitated by coopting a highly talented children's entertainer and song writer with a strong interest in museum education to write a 'soundplay' rather than a scripted word dialogue. The final script consisted of a series of 12 entertaining scenarios, background sound effects and music, changing characters and the occasional song.

Examples of some of the scenarios included:

- a breakfast radio station weather report exploring rainforest climate
- a French fashion parade commentary effusing the latest fashion in rainforest leaf designs
- a reggae version of a specially composed 'Coconut Tree' song exploring the different uses of coconuts
- Aboriginal people sharing their knowledge of rainforests
- trekking through ancient Gondwana rainforest with the sounds of dinosaurs thumping and roaring in the background.

We enlisted the support of local company LEGEND Technology to provide advice and equipment. They recommended and sponsored 40 relatively simple MP3 players with a minimum of 'bells and whistles'. The great advantage of using MP3 players is their flexibility. Students have control over every stage of their learning. They can do the adventure tour in any order, stop at any stage, discuss what they are hearing with others or repeat information as necessary. This allows for mixed age groups and enables students of differing abilities to learn and succeed at their own pace.

The tour was evaluated with a large number of different student cohorts to determine student interest and the functionality of equipment including its distribution and retrieval. Evaluation included individual and group conversations, observation of the tour in progress, interviews by an

external educators and formal written feedback from students. The process was invaluable and led to script modifications and some changes to our equipment choice. Overwhelmingly students were enthusiastic about the way they were able to learn. They connected with the characters and performance approach yet were able to recount the content and information embedded in the tour.

While MP3 tours are not intended to take the place of quality face to face interpretation and or replace two-way conversation, they do provide an alternative to self guiding notes or no interpretation at all. They also provide further opportunities as more schools and individuals own MP3 players. For example, in the near future gardens will be able to have a variety of educational tours available for download online to diversify the interpretive services they offer to schools and the wider general public. Furthermore students themselves may well be writing, producing and presenting their own audio interpretation of our displays for use by fellow students as a way of demonstrating their understanding of a topic.

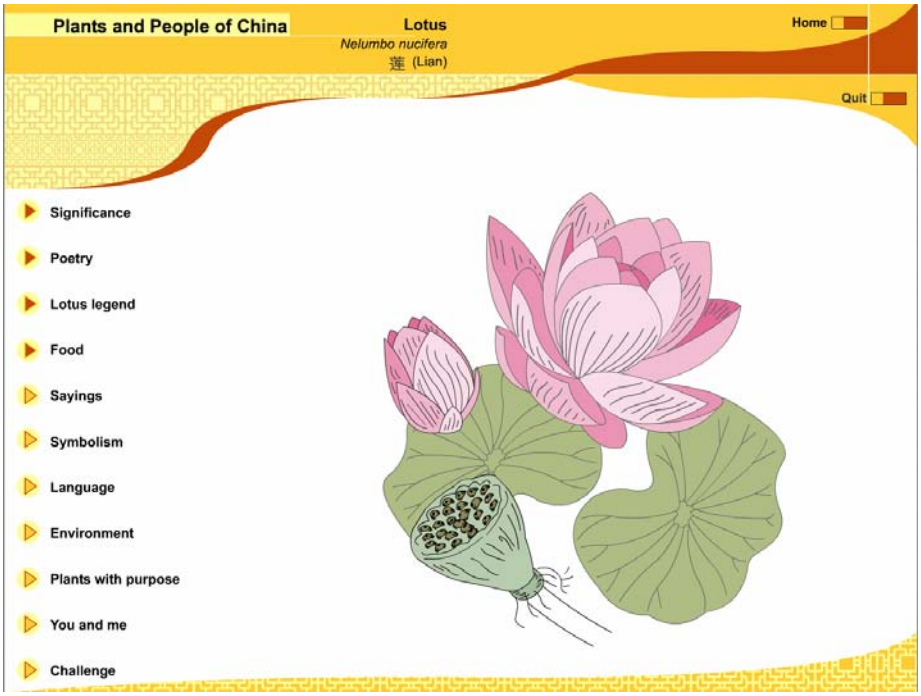
Plants and People of China website: Integrating language, culture and environment through plants @ www.chineseplants.org.au

It has been widely acknowledged in Australia that we need to have a deeper understanding of the ideas and values underpinning Asian societies if we are to truly engage culturally, economically and politically with our geographical neighbours. In recent years there has been a strong focus on the importance of integrating Asian perspectives across our school curriculum. In response to this our garden has developed a number of garden resources that use Asian plants to develop a wider understanding of Asian culture and environment. Our most recent development is a website that integrates online and classroom learning about the plants and people of China.

Chinese people retain a strong connection to the natural world and continue to value the cultural and symbolic role of plants. Even in today's modern world stories involving plants are woven into the everyday lives of Chinese people and they remain a part of the history and traditions of China. Our activity rich website uses these stories as the basis for learning about China across the school curriculum.

Eleven significant Chinese plants were chosen to introduce cultural and environmental information in short bite size chunks and a highly visual way. Interactive learning activities were grouped under the following headings:

- *Sayings* - animations of traditional Chinese sayings associated with specific plants
- *Symbolism* - Chinese plant symbols used as a springboard for student's own symbols for plants.
- *Language* - traditional plant sayings incorporated into a matching game that familiarise users with Chinese characters and language.
- *Environment* - observation and thinking quizzes about issues related to the natural environment using a variety of situational examples.
- *Plants with Purpose* – diverse activities to highlight the importance uses of plants within Chinese life and culture
- *You and me* - plant analogies used as discussion starters for clarifying values.
- *Challenge* - a diverse collation of challenges and investigations that encourage research and reporting back.



The activities are not primarily about plants but rather the insights into culture and the environment that plant stories tell. Many of the activities relate to cultural values and beliefs and where possible integrate relevant Australian perspectives to deliberately blur the boundaries between China and Australia. This approach is designed to encourage students to question their own views and values within a combined Chinese and Australian context.

Many of the online activities can only be completed when taken back to the classroom for further discussion. Some also involve deeper exploration through simple research challenges that require the presentation of data and research. The aim is to have activities that cannot be completed solely online in order to encourage a richer learning experience through discussion, clarification and the sharing ideas with others.

This resource was developed in response to requests from teachers for different practical approaches to teaching language and culture in schools. The very positive response we received from its introduction and requests for something similar from other language teachers highlights the way plants can enrich learning beyond the more traditional areas of biology and environmental studies.

Quiz trails: Embedding learning in large scale events

Big events like world environment day celebrations provide great opportunities for reaching large numbers of school students in a relatively short time. The downside though is that meaningful learning can take second place to

managing the crowds. A quiz trail is one way of addressing this issue.

Over the past nine years we have run our World Environment Day and National Water Week events based on a quiz trail concept. The quiz trail involves students visiting a series of stations seeking out clues from presenters and nearby plant displays to answer a series of simple, quiz type questions. People of all ages seem to love the challenge of a quiz especially when there is the added incentive of prizes, no matter how small they may be. At each station volunteer presenters share their environmental stories through various show and tell objects that arouse curiosity and provide clues to quiz questions. When you throw in some entertainment between the stations and include the beautiful backdrop of a botanic garden, you have a mix that works. It is a remarkably simple formula but each year we find ourselves having to turn away schools because of the increasing popularity of the event with both teachers and students.

This year's world environment day event for over 1600 visiting students had 15 show & tell stations covering issues like weeds, animal homes, biodiversity, plant medicines, sustainable gardens. Volunteer station presenters included experts from NGO's, government environmental organizations, our local zoo, garden staff and guides. Outside organizations readily volunteer their services because the garden delivers them a very large receptive audience on the day. This external support makes the event relatively easy to organize and inexpensive to run.

One of the most valuable outcomes for students from this format is the opportunity to meet and hear from different presenters who are committed, passionate and knowledgeable about the environment. And because plants featured in some way at every station, students come to realize the underpinning importance of plants to the environment and their key role in a sustainable future.

Summary

In an increasingly busy, sophisticated and highly competitive world gardens have to find different ways of presenting plant stories that are enjoyable, relevant and help young people to make meaning from their visit to our gardens. As educators we compete in a media rich world full of messages. The power of our gardens, coupled with learning that is enjoyable, learner centred and connected to young people's lives is the best way to make sure our voice is heard.

Biography

Steve Meredith manages the schools education program at the Botanic Gardens of Adelaide. The position is seconded from the Department of Education and Children's Services to provide curriculum related education programs for schools in South Australia.

Jardín Botánico de Acapulco: An unusual beginning

Kay Mendieta de Alonso

The Acapulco Botanical Garden began as an initiative from the members of the "*Primer Club de Jardinería de Acapulco.*" March 2002 was the Club's 10th anniversary. We wanted to do something special to commemorate this date by creating a Botanical Garden for our City, a project that would provide a place for recreation, and at the same time, raise awareness of the important role plants have in our daily lives.

For several years we had talked about how important it would be for the City to have a Botanical Garden, but precisely it always ended in just "talk". Finally the moment came when all agreed it was time to begin this project; it was also agreed that it should be a showplace for our native plants, and would be a place of tranquillity as well as educational for the community and visiting tourists.

The site needed to fulfil certain criteria: the property had to be free of any liens, location had to be near the City and it should be accessible for the local schools.

Many locations were visited, but finally on the grounds of Loyola University we found a place with many attributes, such as biodiversity representative of the deciduous subtropical forest, access to two natural water sources, great landscape potential plus an outstanding view of the bay, at a short distance from the City of Acapulco and with plants listed as endangered- many of which had already been destroyed by squatters.-

Meetings were held with authorities of Loyola University to present our project, and to show them the benefits of having it on their grounds.

On November 2001, an agreement was signed between representatives of the Garden Club and Loyola University for the use of 6 hectares of the University's terrain for the development of the Botanical Garden.

The first thing the club's 32 members did was a Gala benefit to raise funds to start the project.

For several weeks the site was explored in order to locate trees of importance either by being in danger of extinction, of considerable age or of medicinal properties.

Paths were opened in such a way that areas where huge granite boulders that offered potential for outstanding landscaping would be highlighted.

Once all these focal points were located, boundaries and the trails were laid out; taking into consideration the importance of avoiding steep inclines so walking would be easier.

The construction project was very clear; our priority was to preserve and protect the fauna and flora from the deciduous subtropical forest with paths easy to walk and a landscape design that would attract visitors. Also, we had to adapt to the site, disturbing it as little as possible.

With these criteria, trails were opened and concrete cylinders donated by local construction companies were placed along the boundaries, pruning & removing dead limbs on trees close to the paths.

Native trees (330) and shrubs were planted, and tropical plants with lush foliage were introduced in the landscape design to embellish the trail.

All Club members, our families and friends were invited to participate and after only 160 days of signing the agreement with the University, with $67,000 thousand pesos ($6700 us dollars) collected from the gala benefit, with many hours of volunteer work and with the great passion of the 32 members of the Garden Club, the inauguration took place. It was March 2, 2002.

This essay title, "An Unusual Beginning" relates how this project was initiated. "Unusual" in many aspects:

- None of the members had expertise in environmental or botanical sciences.
- All members participated actively in accomplishing this project.
- The efforts of the members multiplied the results obtained.
- Passion was followed by action.
- The project had no corporate or government support.
- The site was carefully protected, and we were mindful to let the grounds dictate where paths should be opened.
- None of the members ever doubted that it would be achieved.
- The work was finished on schedule.
- It truly enforces the popular saying, "Dream high in order to do big things."

After the inauguration, a short-, medium- and long-range Master Plan was elaborated and work continued in 3 main areas:

- Educational: To encourage more knowledge of the important role plants play in our live- In this area work was done with local schools trough an environmental interactive program, educational signs added to the garden and students invited to visit, also contact with other Botanical Gardens established.
- Conservation: To preserve and propagate plants endangered- Collecting and propagating native species, approximately 80% of existing plants were classified, inventory of plants in 5 x 5 square meters and trees in danger of extinction planted.
- Recreational: To have a space of pleasure and enjoyment - In order to attract visitors tours were offered to tourists and locals.

In October 2004, we were invited to be present at the annual meeting of the "Mexican Association of Botanical Gardens, held in Oaxaca, Mexico. We were delighted to attend, since it was the ideal place to show our project, and learn about the work being done in well established Botanical Gardens.

To our surprise what we had done in an "Unusual Beginning" for a project of this type "was not so bad," and even without any specialists much had been done in only 2 years.

Best of all we were told we could add the name "Botanical Garden" instead of Botanical trail, since we already had tagged our plants with their scientific name, open to the public, promoted educational programs and were collecting and propagating native plants.

From 2002 to 2006 new additions to the Botanical Garden have been done thanks to donations and the work of all Club's members. Some of these are:

- A small nursery and propagation area.
- A display of orchids.
- Three small ponds and a waterfall.
- An amphitheatre for 120 people.
- A water reservoir camouflaged as a pond, to collect pluvial water.
- A secondary bridge for easier access for senior citizens.
- A small unobtrusive building with an office, video projection room, classroom, store and rest rooms.

My interest in presenting this work is my strong belief that every one of us can promote the importance of preserving plant diversity and the need of its conservation. We all can contribute towards this end and plant a small seed for the conservation of our planet.

Conserving Plant Diversity: The 2010 Challenge for Canadian Botanical Gardens

Laurel McIvor

Botanic Gardens Conservation International, Canada

Botanical gardens around the world are playing an increasingly important role in plant conservation and promoting the sustainable use of biological diversity for the benefit of people and the planet. Canada's botanical gardens are interested and actively participating in these initiatives. Both collectively and individually, they are working to increase public understanding about the urgency and importance of maintaining the diversity of biological life on earth.

Canada is a large country with a relatively small, geographically dispersed population. Our botanical gardens and arboreta are a mixture of university-affiliated and private institutions. They are generally small, urban-based, seasonal operations with few full-time employees. A handful are involved in botanical research, many own or manage natural properties and almost all offer educational programmes. Collectively they host over 5 million visitors a year and deliver hands-on educational programs to about 500,000 people (McIvor 2003).

The *Investing in Nature: A Partnership for Plants in Canada* project co-ordinates a network of approximately 25 Canadian botanical gardens, arboreta and other related institutions interested in plant conservation and sustainable living (Figure 1). Through this network we are promoting greater public awareness of the importance of plants, the threats they face, and the actions needed to protect them.

In response to the many relevant national and international programs and policies, the Canadian botanical community has developed *Conserving Plant Diversity: the 2010 Challenge for Canadian Botanical Gardens.* This plan of action is a follow-up and update to the 2001 *A Biodiversity Action Plan for Botanic Gardens in Canada*. It is the framework for expanding and improving plant conservation efforts and education for sustainable development at our institutions over the next five years (Galbraith & McIvor 2003).

Figure 1: Map of Canadian Gardens participating in the "Partnership for Plants in Canada"

Progress and successes on recommendations and targets in the last five years are grouped under five key themes. New recommendations toward the conservation and sustainable use of plant diversity have also been developed. The plans and intended outcomes for engaging Canadians in "Conserving Plant Diversity" are in listed in measurable targets, grouped under the same thematic areas:

Theme 1: Conserving and Promoting the Sustainable Use of Natural Plant Diversity

Image 1: Christmas tree barrier in wetland restoration, Royal Botanical Gardens

Progress & Successes to date:

- Participation in recovery planning for endangered plants and habitats
- Encourage preservation of important sites for plants *in situ*
- Development of native plants gardens or sections in gardens

Recommendations for 2011:

- Broaden participation in protecting natural areas, habitats and ecosystems
- Strengthen link between botanical gardens and national conservation programs
- Increase research partnerships in pure and applied conservation biology
- Expand participation in conservation of medicinal, economic and ornamental plants, including heirloom varieties
- Develop a system of unified signage for plants at risk in collections

Theme 2: Enriching Biodiversity Education

Image 2: "Shoots with Roots" Education Programme, Milner Gardens & Woodland

Progress & Successes to date:

- Educating the public about the wonder and importance of plants through formal and informal education is a central role and mission priority for most gardens
- Development of educational materials about endangered plants and plant conservation, i.e. "CBCN for Kids": www.rbg.ca/cbcn/en/cbcn4kids/kidsindex.htm
- Construction and display of the *Green Legacy* travelling museum exhibit on rare plants launched in 2002 by the Canadian Museum of Natural and Royal Botanical Gardens
- Development of a variety of conservation and biodiversity educational resources through the *Investing in Nature: A Partnership for Plants in Canada* programme including training, interpretive signs & pamphlets, a traveling exhibit, on-line materials & resources for educators, and compiling/linking resources on current research and conservation activities

Recommendations for 2011:

- Continue to emphasize the importance of plant conservation in education programs at botanical gardens by seeking new resources, promoting networking and supporting meetings of educators
- Work co-operatively to support and share existing programs that promote professional best practices in conservation
- Promote conservation messages in all interpretation and expand efforts to actively engage Canadians in conservation

Theme 3: Supporting the Foundations of Research

Progress & Successes to date:

- Publication of a directory of plant conservation activities in Canada and a list of botanical gardens collections in Canada
- Contributions to BGCI's on-line garden/ collections database

Recommendations for 2011:

- Compile results of research projects conducted by botanical gardens, including a list of publication titles produced each year
- Support the Flora of North America (FNA) project, including linking FNA into education programs and assisting with taxonomic review where capacity permits
- Share and regularly update plant records with the BGCI global database of plants in cultivation

Theme 4: Encouraging Best Policies and Practices

Image 3: "Path to Biodiversity" at Montreal Botanical Gardens

Progress & Successes to date:

- Development of partnerships at several gardens with indigenous communities on conservation activities and stewardship issues
- Organisation of two major meetings of botanical gardens in Canada in 2004 and 2006
- Co-ordination of yearly meetings at the annual conferences of the American Public Gardens Association

Recommendations for 2011:

- Launch a coordinated invasive species effort among gardens, including development and promotion of guidelines and policies, educational programs and training

- Develop new approaches to promote sustainable use of plant resources, including public awareness, professional standards and best practice, and raising awareness of laws such as CITES
- Continue collaborating with local communities to support sustainable use and conservation of wild plant communities
- Create educational and training materials to promote sustainability, conservation ethics and environmental awareness within all levels of botanical gardens
- Organize and maintain a roster of plant conservation experts in Canadian botanical gardens, and promote awareness of this expertise to relevant conservation partners
- Facilitate regular communication between botanical gardens to address plant diversity and conservation issues

Theme 5. Cultivating Partnerships, Resources and Capacity

Progress & Successes to date:

- Development of network options and new sources of funding support
- Establishment of the Canadian Botanical Conservation Network, including a regular newsletter, the CBCN web site, a list server and incorporating as a registered charitable organization
- Exchange of information on plant conservation issues and practices through the network, and development of educational and practical projects involving members and stakeholders

Recommendations for 2011:

- Collectively contribute to national dialogue and policy with regards to plant conservation, including development of new programmes and resources
- Form new alliances to promote the importance of plant conservation, and better share and promote existing information and resources
- Provide an active forum for leading gardens to share information, raise awareness and offer guidance to other institutions through on-going web sites, newsletters and meetings
- Create a strategic plan to address network development through 2011

Botanical gardens, arboreta and other institutions across Canada have shown an interest and commitment to networking and sharing best practices of conservation and biodiversity education. Although modest in size and resources, collectively these institutions can make meaningful contributions to the conservation and sustainable use of plant diversity. We plan to respond to the challenge of attaining the 2010 plant conservation goals as a community, knowing that our contributions are part of a long term solution.

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Inclusive environments and the application of inclusive design principles to botanic garden sites

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What is inclusive design?

Inclusive design is a way of designing products and environments so that they are useable and appealing to everyone regardless of age, ability or circumstance (Ormerod and Newton 2005).

Whilst a range of terminology with similar meanings is and has been used, including inclusive design (UK), universal design (USA), design for all, barrier-free design, transgenerational design and life span design, it is important to differentiate between inclusive design and accessible design.

Story (2002) defines accessible design as 'design to accommodate specific individuals or groups of individuals with disabilities'. Whilst acknowledging that accessible design will always be necessary, at least in certain situations, she states that accessible design may segregate and stigmatise the users it is designed to accommodate. An example of accessible design is the provision of a swing or power door next to a set of revolving doors to give access for those unable to enter the revolving doors.

Story identifies that 'universal design can be distinguished from accessible design in the way that the accessible features have been integrated into the overall design' (Story 2002). An example of universal (or inclusive) design is a set of power doors that is convenient for all users.

Disability and demographic change

Worldwide there are over one billion disabled people. In Britain alone there are over 8.5 million disabled adults, 20% of the adult population, of which 21% have severe impairments (Keates and Clarkson 2004).

Figure 1 (Coleman 2003) shows the types and distribution of impairments for the European population.

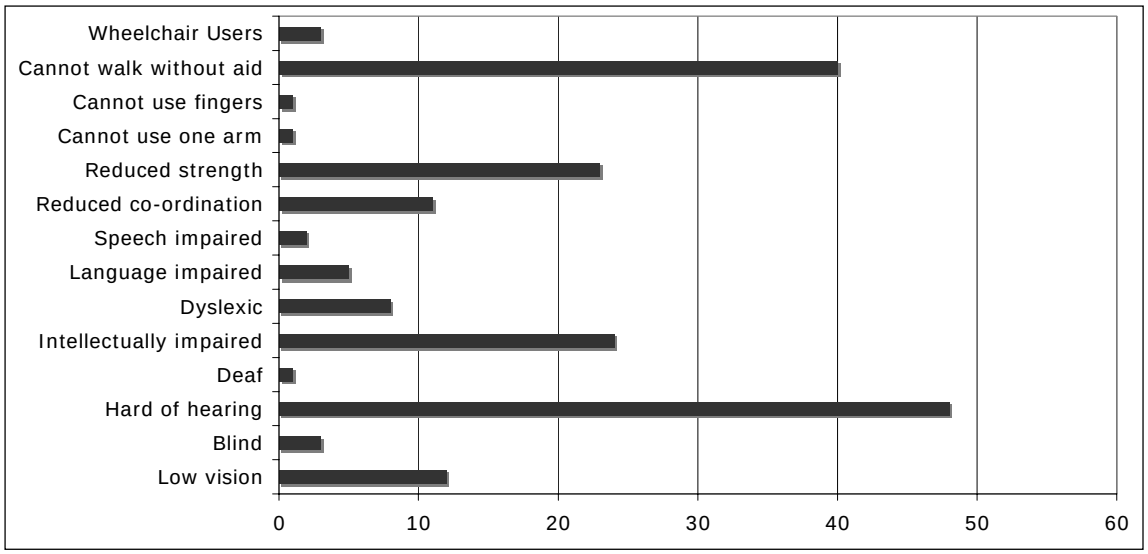

Figure 1 Disability in geographic Europe – millions affected out of a total of 800M (Coleman 2003)

The situation is similar in the United States where there are approximately 50 million disabled people, representing 20% of the population (US Census Bureau 2002).

Populations are also ageing (figure 2, Keates and Clarkson 2004).

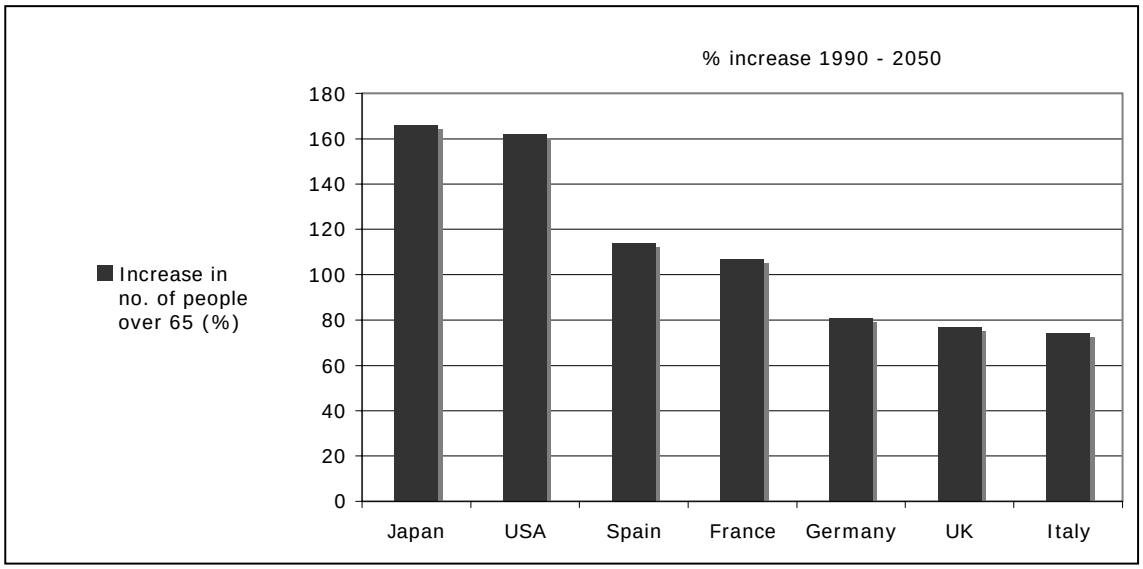

Figure 2 Increase in the number of people over 65 for a sample of countries (Keates and Clarkson 2004)

With age, 'people change physically, mentally and psychologically. For most people these changes involve multiple, minor impairments in eyesight, hearing, dexterity, mobility and

memory' (Design Council 2006). In the United States 42% of people aged 65 and over have an impairment (US Census Bureau 2002).

By 2020 close to half the adult population of the UK will be over 50 years old, while 20% of the inhabitants of the United States will be over 65. In Japan 25% of the population will be over 65 by the year 2020. Furthermore, 'it is virtually certain that this demographic situation is here to stay and will finally spread over the world' (Coleman 2003).

The importance of inclusive design to botanic gardens

Fifty percent of botanic gardens are concentrated in Europe and the United States (Wyse Jackson and Sutherland 2000) where there are rapidly ageing populations and significant numbers of people with impairments.

With the demographic situation predicted to spread over the world (Coleman 2003), a growing interest in inclusive design is likely to develop worldwide.

In many countries there is legislation aimed at tackling discrimination and enabling access, for example the UK Disability Discrimination Acts 1995 and 2005, and the US Americans with Disabilities Act 1990. Whether or not legislation exists, 'best practice' will value people's diversity and work towards equality of experience for all staff and visitors.

The UK Countryside Agency (2005) identifies the benefits of an inclusive approach to outdoor sites as including:

- Increased visitor satisfaction
- Greater staff and volunteer satisfaction
- Positive image
- Increased repeat visits
- More effective use of resources by avoiding short-term ad-hoc measures
- New audiences
- Expanding employment and volunteer opportunities
- Increased income.

The defining characteristics of a botanic garden (Wyse Jackson and Sutherland 2000, citing IUCN-BGCS and WWF 1989) include being open to the public, communication of information, the adequate labelling of the plants, education activities and research. Therefore, there are clearly benefits to botanic gardens within their diverse roles in adopting an inclusive approach.

The principles of inclusive design

Connell et al (1997) compiled a set of seven principles of universal (or inclusive) design. These are summarised in figure 3. The principles offer guidance to better integrate features that meet the needs of as many users as possible.

1.	**Equitable Use**	The design is useful and marketable to people with diverse abilities.
2.	**Flexibility in Use**	The design accommodates a wide range of individual preferences and abilities.
3.	**Simple and Intuitive Use**	Use of the design is easy to understand, regardless of the user's experiences, knowledge, language skills or current concentration level.
4.	**Perceptible Information**	The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5.	**Tolerance for Error**	The design minimises hazards and the adverse consequences of accidental or unintended actions.
6.	**Low Physical Effort**	The design can be used efficiently and comfortably and with a minimum of fatigue.
7.	**Size and Space for Approach and Use**	Appropriate size and space is provided for approach, reach, manipulation and use regardless of user's body size, posture or mobility.

Figure 3 The Principles of Universal Design (Connell et al 1997)

Illustrating the Principles of Inclusive Design – The Eden Project

Context – The Eden Project, Cornwall, UK

The Eden Project (figure 4) aims to connect plants, people and places both locally and globally. It contains more than one million plants representing 5,000 species from many of the climatic zones of the world, a large number of which are grown in Eden's two gigantic biomes. Eden opened its doors to the public in 2001 and currently welcomes one and a quarter million visitors each year (www.edenproject.com).

Figure 4 The Eden Project, Cornwall, UK

Examples have been identified at The Eden Project to illustrate the seven principles of universal (or inclusive) design outlined in figure 3 above:

Principle 1: Equitable Use

Scented plants in containers of varying heights in the 'Plants as Perfume' exhibit (figure 5) enable people with diverse abilities to enjoy the display. All visitors have the same means of use, including seated and standing adults and children, and they can use their senses of sight, smell and touch to enjoy the exhibit. The design is appealing to all visitors and no users are segregated or stigmatised.

Figure 5 Scented plants in containers of varying heights in the 'Plants as Perfume' exhibit at The Eden Project

Principle 2: Flexibility in use

The Eden Project offers visitors a wide choice of methods for moving around the site. Visitors may choose to walk following routes with steps or on paths. They may choose to borrow a manual wheelchair on arrival or book a powered wheelchair in advance. The land train, which can accommodate up to three wheelchairs in the rear carriage (figure 6), transports people to the biomes and back, and Eden also has 'golf' style buggies available for use as required.

Figure 6 The rear carriage of the land train at The Eden Project

Principle 3: Simple and intuitive use

The hinged lids on the olive oil vats (figure 7) in the warm temperate biome intuitively invite visitors to lift the lids and discover more about the uses of olive oil inside the vats. The design of the exhibit is easy to understand and is consistent with user expectations and intuition.

Figure 7 The hinged lid of an olive oil vat in the warm temperate biome at The Eden Project

Principle 4: Perceptible information

Interpretation at The Eden Project includes the use of Widget symbols (figure 8) which are used by an increasing number of people with learning disabilities. Symbols can support independence, aid understanding, increase involvement and improve access to information.

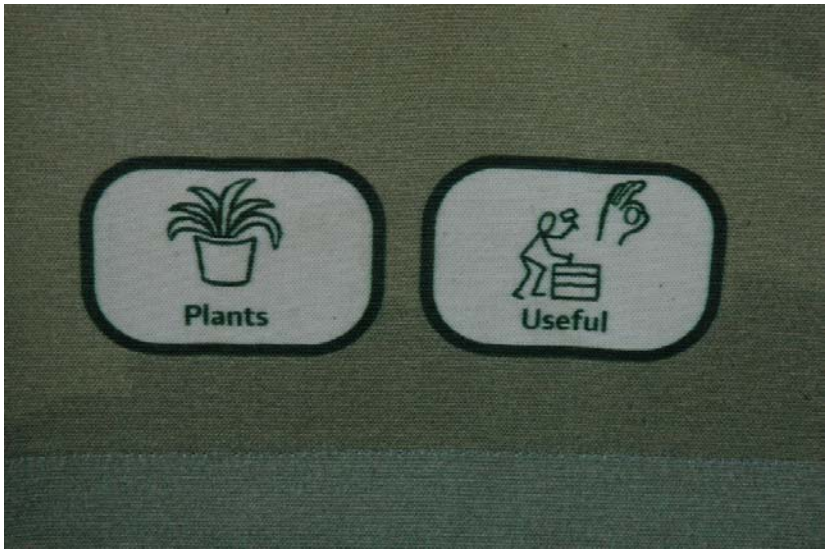

Figure 8 Widget symbols on the 'Hemp' interpretation panel in the outdoor biome at The Eden Project

Principle 5: Tolerance for error

Water can present a serious hazard but in the humid tropics biome the attractively-designed bridge (figure 9), with good side protection, shields the hazard and minimises the risk of adverse accidental actions. Clear warning signs are also well positioned close to the bridge.

Figure 9 The bridge over the water feature in the humid tropics biome at The Eden Project

Principle 6: Low physical effort

Sustained physical effort is minimised around the site by the regular provision of seating. This makes a visit to Eden more comfortable and reduces fatigue. A variety of seating solutions are offered including seating in attractive settings (figure 10), in shade, opposite points of specific interest, flexible seating, seating that is part of exhibits and seating integrated into barriers.

Figure 10 Bench seating at The Eden Project

Principle 7: Size and space for approach and use

The Zzub Zzub café provides appropriate space for approach and use. Figure 11 shows that sufficient space is provided to accommodate a wheelchair, highchair and buggy, whilst still allowing room for other visitors to pass between the tables.

Figure 11 Table spacing in the Zzub Zzub café at The Eden Project

Conclusion

This paper has provided an introduction to inclusive design and presented an overview of worldwide disability data and demographic change. Examples from The Eden Project, Cornwall, UK have been used to illustrate the principles of inclusive (or universal) design. It can be seen from these examples that, in a botanic garden setting, the successful adoption of an inclusive approach spans many areas including education, interpretation, buildings and maintenance, facilities management, landscape architecture and horticulture. Inclusive design is a constantly evolving philosophy (DRC 2003) and needs to become an integral part of the organisation-wide culture.

Plants and flowers can offer some of the most sensory, beneficial and pleasurable experiences available to many people. Botanic gardens are in the unique position of being able to harness their wealth of rich plant resources, achieving their aims while offering true equality of experience for all.

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All photographs taken by the author at The Eden Project, 16th and 17th July 2006.

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Biography

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