

Success Stories in Plant Based Classroom Curriculum Development

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The New York Botanical Garden is a leader in plant science education, with over 100 years of experience in plant science education. This past year, nearly 80,000 elementary school students and their teachers visited the Botanical Garden. Groups participated in both informal and structured learning experiences, all of which are inquiry-based, where students investigate, question, explore, and observe, much like actual scientists. Programs also promote constructivist learning, building on prior knowledge, framed in a familiar context.

This case study describes how we have met the challenge of serving an expanded audience through innovative curricula that bring even richer learning opportunities into local classrooms, and beyond.

Background

The Botanical Garden has three facilities designed for children. The Everett Children's Adventure Garden is the centerpiece, opened in 1998. This 12 acre indoor/outdoor garden consists of six galleries and approximately 50 hands-on exhibits that teach about plant parts and their functions, the plant life cycle, and ecosystems. Children are encouraged to use all their senses as they explore this rich learning environment.

Then there is the Howell Family Garden, an outdoor gardening facility where, under the supervision of education staff, children plant and tend their own garden plots. They learn about horticulture and gardening while they tend and water plants, harvest and taste fresh produce, dig for earthworms, and make botanical crafts.

GreenSchool is a structured learning environment in the Enid A. Haupt Conservatory, where school groups explore specific topics such as rain forests, deserts, or photosynthesis. Botanical Garden staff engages students in exciting activities and classroom lessons before embarking on an expedition to conduct research, collect data, and make observations on some of the many exotic and unusual plants in the Conservatory, 50 Acre Forest, or elsewhere on the Botanical Garden's 250 acres.

Curriculum Development

Even certified teachers, particularly at the elementary level, are generally unprepared to teach plant science. Observations and feedback from teachers also indicated that teachers who brought their classes to the Adventure Garden were not comfortable providing plant science content to their students and needed additional assistance.

To meet this need, it was determined essential to develop standards based classroom curricula that would create a seamless feedback loop between Botanical Garden based learning and classroom learning through pre and post visit lessons. The units needed to have lessons and activities that teachers could easily implement. With generous funding from donors, the local curriculum initiative was launched.

The outcome of this initiative is the Garden Adventure SEEDS curriculum units. SEEDS (Science Exploration and Exploration Education Discovery Series) are classroom curriculum resources that help elementary teachers improve science literacy through a series of fun, hands-on, inquiry-based lessons and trips that create a seamless feedback loop between classroom science and explorations at the Botanical Garden. In addition to a teacher's guide with easy to implement lessons, reproducible activity sheets, and a student certificate of completion, each unit comes with hands-on materials such as a class set of hand-lenses, seeds for planting, measuring, dissecting and examining, activity materials, and related books. These are contained inside a durable plastic carrying case.

Unit 1, for Kindergarten and first grade, introduces students to plant parts and their functions. Unit 2, for second and third grade teaches about plant adaptations, and Unit 3 for fourth and fifth grades addresses plant-animal interactions such as pollination and food webs. These three units represent a significant step towards our ongoing goal of better plant science in classrooms.

What Makes SEEDS Unique

While learning about plants, adaptations and ecosystems are mandated concepts, the majority of education resources teach these with a focus on animals, in which plants play a passive role. The SEEDS lessons depict plants as active and participatory, and help children to see plants as more than food for animals, or habitat for wildlife. The term *plant blindness* has been used to describe this lack of recognition of plants, despite their dominance in every landscape and their essential role in sustaining life on Earth.

Another unique element of these curricula is that the adaptations and interactions described are specific to plants and animals that can be observed by students in the New York Metropolitan area. Focus on species that are encountered daily helps cement the idea that science happens all around us, and is relevant to our daily lives. Hinging lessons on everyday phenomena such as falling leaves or floating dandelion puffs, was done to increase student interest and to draw on their untapped prior knowledge.

Strong literacy and math connections were included due to their central role in the No Child Left Behind legislation, and the clear relationship between numbers, language, and the natural world. Reading and writing opportunities make the unit appropriate to use during literacy time slots in schools; a wealth of measurements, sorting and graphing activities makes each lesson easy to include in math time slots.

Each unit was designed to include vouchers for two class trips to the Everett Children's Adventure Garden, one day of Professional Development on SEEDS at the Botanical Garden, and one Pre-Trip Pass for teachers to familiarize themselves with the Botanical Garden. Including pre-paid vouchers made it easier for teachers to carry-out trips, and allowed the units to be purchase with funds earmarked for school trips, professional development and/or classroom resources.

A professional development workshop was created for each unit to familiarize teachers with the lessons, provide a refresher on basic plant science, and show them how to run the field trips. Our Manager of Professional Development created and delivered the workshops, which took place in the Everett Children's Adventure Garden in both spring and fall, or on a request basis with a minimum enrolment of 12 teachers.

Creating Lessons

All lessons were created with input from curriculum experts, pilot teachers, and independent evaluators. Many lessons drew from existing activities and programs that are successful components of the Botanical Garden's on-site programs. An initial subject outline was followed by development of each lesson by veteran classroom teachers and science educators. Lessons were built around curriculum learning goals, phenomena that could easily be observed or tested, and seasonal learning opportunities such as pollination, fruit production, leaf fall, and conifer adaptations to winter.

Formative Evaluation

Initial lesson evaluations were done by teachers. This critique was based on alignment to standards, ease of use, age appropriateness, and relevance to learning goals. This feedback was used for initial lesson revisions. Once all lessons were complete, a pilot test was conducted. Approximately forty pilot teachers from local schools were invited to test each unit in their classrooms. Each pilot teacher was asked to complete a one page evaluation form for each lesson. Between 25 and 36 teachers were able to participate in each pilot study. These were forwarded to a team of outside evaluators who reviewed them along with making their own assessment of the lessons and the units as a whole. A written report was submitted with recommendations on what activities worked well, which did not, what should be changed and what successful elements should be replicated or enhanced. After being reviewed, modifications were incorporated into the lessons.

Kit Assembly

Once the manuscript was complete, and copyright-free graphics added, the lessons underwent proofreading and editing for style, layout and content. They were then sent to the printer for printing and binding. Covers for the units and accompanying book covers were designed by the Botanical Garden's in-house Graphics Department. Unit assembly was done with help from dedicated volunteers and interns who worked with the staff to cut, count, sort, bag, and label the hands-on components of each unit. A total of 400 of each of the first two units was created, all of which were warehoused on-site. Hand assembled components ranged from felt flower parts to labelled baggies of real seeds, beans and preserved fruits. The third kit was sent directly to the publisher for printing and assembly.

The success of the SEEDS curricula has far exceeded expectations, and is a testament to the hard work and careful planning that went into this project. With \$570,000 generous funding from donors such as Verizon Foundation and Chevron/Texaco, the Botanical Garden invested close to 5 years on this initiative. The first unit, SEEDS 1 was created in the first two years, followed by SEEDS 2 in the next two years and SEEDS 3 in the final year. Lessons learned along the way streamlined the creative process and the resulting quality of all units, and laid the groundwork for future curriculum initiatives.

Dissemination

Dissemination of the units was carried out through several means. Each unit was launched with an event in the Everett Children's Adventure Garden to which local education leaders, teachers, and members of the education press were invited. A press release sent to local media resulted in several features, and a television and radio interview. Presentations at local and regional education conferences, direct mailings to teachers, and promotion through the Botanical Garden's Web site, and School Programs catalogue were ongoing.

The greatest number of sales arose from bulk orders from Principals and regional science staff. Strong links to New York City curriculum scope and sequence, and National Science Learning Standards contribute to the unit's approval among educators and administrators. That the units address multiple learning modalities, are affordable and easy to implement, and teachers report that students enjoy the activities was also key.

Publication

Originally created for local distribution, Garden Adventure SEEDS proved appealing not only to educators but also to publishers, several of whom approached the Botanical Garden with requests for publishing and distribution rights. Because this program was accessible only to groups able to book class trips to the Botanical Garden, publication was seen as a means to extend the reach of these curricula to a wider audience.

The units are now being disseminated through a partnership with Kendall/Hunt; America's leading publisher of standards based K–12 curricula, thus insuring that students across the nation benefit from these resources.

Their first print run is a New York version designed to meet high local demand. The units will no longer include free trips or trainings, but rather include a discount on both.

Next Steps

The next step will be national dissemination by Kendall/Hunt. This would require a new print run with either a national version, or several regional versions. These may require modifications for field trips in different habitat types, seasonal patterns, and species assemblages. In that case, the Botanical Garden will work with the publisher to ensure that changes do not compromise the quality of the lessons. An international version or translation could be available in the future.

Several curriculum projects that address the classroom learning needs of middle and high school audiences are underway. It is more difficult for students in these grades to take field trips due to complex class schedules. Curricula for these grades will include hands-on lessons, on-line learning, and multi-media components such as videos. The Botanical Garden is currently discussing distribution with several publishers. Additional forward thinking curricula with global relevance and Web-based content are being formulated, and we look forward to reporting on these at subsequent conferences.

The overwhelming success of these curricula has led to several new challenges and opportunities. Some key questions that must be addressed include learning how the Botanical Garden can parlay this success to benefit even more learners, forge new collaborations, target and address new audiences, and create new and innovative ways to deliver content in a fun and engaging way.

The Botanical Garden will continue to seek answers to these questions and explore new opportunities in curriculum development. I appreciate having the opportunity to present these initiatives and am grateful to BGCI and the conference participants for your kind attention.



Dr. Colón, Curator of Curriculum Development and Evaluation with the SEEDS 2 Curriculum Unit on Plant Adaptations for 2nd and 3rd grade students.

Botanic gardens and place identity: Informing a more relevant educational practice

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Botanic gardens through their history and time-honoured practices have become significant holders of place meanings and are often at the centre of cultural landscape issues across the globe. Botanic gardens, especially in the colonial world, now face the challenge of implementing a more relevant course of action that focuses attention on livelihood and environmental justice. The Durban Botanic Gardens is a case in point where these processes are being actively explored through the Garden Window Project. However, this project requires a new approach for actively and meaningfully engaging with people-plant relationships; one that relies on place associations, narratives and the manner in which plants and place identity provide meaningful learning opportunities for people.

Most interpretation is aimed at visitors from outside the immediate area. But involving local people in thinking about what makes their place special, and how they might tell others about it, can help them find a new sense of pride in their own area. For some projects, this may be the most important thing of all, and any actual end product only secondary (Carter 2001:8).

1. Introduction

The Durban Botanic Gardens is located within the city of Durban, in walking distance from a major transport node, Warwick Triangle, the site of one of South Africa's largest traditional medicinal plant markets. The 'Gardens', is currently the oldest surviving botanic gardens on the African continent. Established in 1849, the Gardens was developed with the express purpose of experimenting with potential agricultural crops (economics), and served as a botanic station supporting the movement of economics throughout the colonial world (McCracken 1996).

2. Background

This paper is based on research conducted at the Gardens during 2004. A total of 28 interviews were conducted from late June to early August. Respondents included people who were employed, volunteered or visited the Gardens on a regular basis. The study aimed to investigate and understand how issues of place identity and cultural landscape function at the Durban Botanic Gardens. This paper aims to explore the features of place identity and the cultural landscape evident at the Durban Botanic Gardens as way of directing the Gardens' interpretation/environmental education programme. This is particularly important given the local environmental context in which the Durban Botanic Gardens is located i.e. in one of the world's fastest growing cities with a range of social development issues: poverty, unemployment and HIV/AIDS. These issues are juxtaposed amid the city's rich natural and cultural heritage.

Places are more than just physical spaces occupied by people. Rather they are better understood in a phenomenological sense, as dynamic and layered holders of meaning(s) for the various groups of people associated with them. Place need not be just a bounded physical space (in fact

one is more likely to discover that the boundaries of places are porous, ‘bleeding’ with meaning(s) and influence); imaginary places like physical places, shape our identity and we in turn through our own subjectivity, socially construct the places of significance in our lives. This experience, or sense of place, is constructed on the basis of a number of ‘elements’ or modes of interpretation as suggested by Galliano and Loeffler (1999): ‘Sense of place is a combination of elements that according to cultural geographer Ryden (1993), includes four essential qualities: personal memory, community history, physical landscape appearance and emotional attachment’ (Galliano & Loeffler 1999:2). Cultural landscape is that which is ‘value laden’, possessing an ‘identity value’, hence meaningful and considered worthwhile preserving (Arntzen 2002).

The Durban Botanic Gardens, by its history alone, is a ‘time thickened’ place within the Durban cultural landscape (Crang 1998). The Gardens as a significant place is imbued with meanings layered in the tradition of horticultural and social practice that both serve and link various cultural groups (some previously excluded) both locally and globally. The Gardens can be viewed as a ‘hybrid’ space, reflective of societal attitudes, values, perceptions, and knowledge of plants and their relationships to people. Botanical collections are more than just assemblages of select groups of plants in a bounded physical landscape. Rather they represent much larger ambitions and politically motivated narratives linked to people-plant-environmental relationships.

Botanic gardens can also be regarded as **palimpsests** or places in which select societal values have come to be readily expressed, discarded or upheld over time. Places are the ‘fundamental means’ in which we interpret the world around us and pursue action. Our identity is located in places, informing us of who we are and how we should behave. The result is an ongoing social construction and reconstruction of places (Cheng *et al* 2003). Places are given meaning through action. Place is always made through the action of doing ‘through everyday processes of participation’ (Mackenzie 2004). The result of human doing and action in place is the build up of layered cultural meanings over time. It is only in place that culture can exist and be manifested.

Tuan (1974) provided an explanation of place as a concept linked not just to ‘position in society’ and ‘spatial location’, but rather one associated with spirit and personality: ‘...places, like human beings, acquire unique signatures in the course of time’ (Tuan 1974: 233). It is this ‘personality’ that may command awe or evoke affection. Tuan’s places are ‘non-directed homogenous spaces’, having a ‘stable existence’, and are recognised as public spaces and/or ‘fields of care’. These qualities are expressed in landscape icons such as monuments, which add significance to a locality, transforming it into a place, and making the locality a ‘centre of meaning’:

All places are small worlds...Places may be public symbols or fields of care, but the power of the symbols to create place depends ultimately on the human emotions that vibrate in a field of care. (Tuan 1974: 243)

3. Examples of research results: place-based narratives

i) Botanical nationalism

One fascinating issue that emerged in the above research was the notion of ‘botanical nationalism’, a concept which suggests that plant collections are not neutral assemblages of plants but represent certain single minded foci that are reflective of a nationalistic agenda. In the same manner that statues and monuments may kindle nationalistic fervor, specialized botanic gardens such as Kirstenbosch develop feelings of national pride. For Osborne (2001), place and identity

may be intentionally manipulated or socially constructed to create national identity in the iconography of monuments and elements of national heritage:

RES 5: [T]he South African trend at the moment which is essentially what I think one could call botanical nationalism, which has all the faults and the advantages of nationalism... Botanical nationalism goes further because what worries me about it is that like all ideologies, it tends to become cliquish and it tends to become exclusive and because of that it creates a them and us and I think that is unhealthy.

The sense of identity associated with the Durban Botanic Gardens and especially in light of the above concern about what has been referred to as 'botanical nationalism' is indicative of the manner in which place meanings serve to create a notion of *othering*. According to Cheng (2003), 'Identity is a powerful behavioural influence, for the process of distinguishing oneself from others lends meaning and order to an otherwise chaotic world...' (Cheng *et al* 2003: 93).

ii) Sense of ownership

The Gardens because of their history, botanical and social traditions is a prime example of a place where sense of ownership is made strong through long term association, and in some cases extended from generation to generation within the same family of visitors. The Gardens has been linked to significant events in the life of the following visitor who through the effects of Apartheid, was forced to move along with his family away from close proximity to the Gardens. However by that stage the Gardens had already served some major milestones in the respondent's life allowing him, despite all the hardship of forced removal, to 'claim ownership of the Gardens'. According to the respondent he has been visiting the Gardens for the past 60 years!

RES 18.: I sort of uh claim ownership of the gardens you know...not legal ownership but I, I feel that I've have been here for so, I've been through the gardens for so many years that uh I may be part of it... almost my entire life has been spent here uh all be it for a few periods, you know: playing as a child, coming again as, as a high school student, coming with uh, with uh girlfriends, coming again when, when I got married. Even though I've come at very isolated times...I still feel that I uh, I own part of the Gardens...And of course because I was, I was born in the, around the corner and I lived my entire, twenty one years...over here and then after twenty one years old I, we were moved to Sydenham because of the group areas act but I spent the uh greater part, of most of my childhood just around the corner.

4. Place identity and the planning of interpretation / environmental education programmes

According to Carter (2001) Interpretation is an integral part in promoting special places such as monuments, old buildings, a historical event etc. Without interpretation it may be difficult for a visitor to feel the significance of a site such as a battlefield. Interpretation therefore uncovers the significance of special places, the sense of care for a particular place, and aids in unlocking the identity of particular places.

Interpretation is a means of accessing our heritage and uncovering hidden narratives that reside in special places. Freeman Tilden (1977), the first to publish on the subject of interpretation aimed

to move people beyond simply being told and knowing the facts about a place to developing a sense of value for significant places and internalising a sense of care that could motivate the need to help conserve important sites. This has significance for environmental education practice by allowing various groups of people to contribute fresh ideas about a place, provide new insights, as well as new ways of looking that serve to invigorate special places such as botanic gardens and in turn provide visitors access to an authentic place experience.

5. Conclusion

The Durban Botanic Gardens possesses a unique place identity, given the traditions and cultural landscape practices that have come to be represented in the artifacts and practices of the place. As a place considered stable and ‘time thickened’ through years of practice and sentiment, the findings show that despite past exclusions, Indian and African people in Durban still developed a sense of place identity at the Gardens. The proposed Garden Window Project has the potential to embrace the integrated social changes envisaged by the city of Durban. It is therefore appropriate that a place-based approach is applied in order to foster a new culture of relating through plants to the needs of local communities. This will ultimately aid in developing a more meaningful public horticulture and environmental education programme.

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Biography

Martin Clement is education officer at the Durban Botanic Gardens, South Africa where he is responsible for school and visitor education/interpretation and community outreach programmes.



Main entrance to the Durban Botanic Gardens (photo: Hans Heiligendorf, SANBI)



Caption: Providing learning opportunities for all (photo: Martin Clement)



Caption: A trader at the Warwick Triangle medicinal plant market, Durban (photo: Martin Clement)

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, Meltzoff, 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

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Connecting People with Plants

Mr Steve Clancy

Royal Botanic Gardens Melbourne

Introduction

The Royal Botanic Gardens manage two very diverse sites that offer unique experiences for visitors. The Royal Botanic Gardens Cranbourne (RBGC) is situated on 363 hectares of remnant bushland and reclaimed farmland, enticing visitors with heathlands, wetlands and woodlands. The opening of Australia's newest botanic garden "The Australian Garden" in May this year has thrust RBGC into the spotlight and dramatically increased visitation and interest in the site.

Established in 1846, the Royal Botanic Gardens Melbourne boasts impressive landscapes featuring rich and vibrant living collections from both Australian and overseas origins.

Early in 2005, the Royal Botanic Gardens released a new charter and three-year corporate plan. The plan provides direction for activities across both the Melbourne and Cranbourne sites through the identification of strategic goals. The goal relevant to this paper is stated below:

Enhancing on-site experiences and providing programs for a broader spectrum of the community. (RBG Corporate Plan 2005 – 2008)

The corporate plan outlines the Gardens intention to increase the relevance and diversity of programs and to make these available to a wider audience than has previously been reached.

Formation of Working Group

The Gardens have a strong record in the provision of schools education with a range of programs catering for early childhood, primary, secondary and tertiary groups. The opening of an award-winning Children's Garden in 2004 has seen these programs grow in popularity, peaking in 2005 with a total of 27,523 participating students. Independent visitors to the Gardens are also engaged through interpretative signage and a robust program of guided walks.

The RBG was looking to continue to deliver these programs without compromise while exploring opportunities to reach new audiences in an effort to connect more people with plants. The RBG applies the term "community engagement" to this diversification of programs and increased community involvement and partnership.

In July 2005, a multi-disciplinary working group was formed to develop the strategy to achieve the objectives set out in the corporate plan. Consisting of members from executive management, RBGC Public Programs, Marketing, Development, Plant Sciences and RBGM Education and Visitor Services the working group set about defining the Gardens approach to community engagement. It was acknowledged that the Gardens existing programs directed to current audiences were well regarded and were achieving stated goals. The challenge lay in targeting new audience segments to raise awareness and appreciation of the Gardens and of the importance of plants. The working group initiated a review of programs, activities and outputs of the whole organisation with a view to developing a new strategic direction.

The Framework

The following is an outline of the framework for the Gardens' long term community engagement vision based on the work done to date by the Community Engagement Working Group.

Two streams have been identified:

- Sustainable Gardening
- People, Plants and Culture

Target audience segments:

Schools learning

Programs and activities available on- and off-site to the schools audience, including facilitated on-site programs, web-based activities, self guided activities, etc
Currently supported by Department of Education and Training and Catholic Education Office grants.

Vocational learning

Programs and activities providing specialist job-based knowledge and skills, and competency building in specific disciplines to defined industry-based or professional audiences.

Tertiary learning

Programs and activities provided to tertiary audiences, either on- or off-site.

Adult Learning

Includes short courses delivered on- or off-site, potentially with partner organisations, and accredited training courses

Visitor discovery

Static (eg. signs), electronic (eg. web-based, podcast) and face-to-face interpretations, holiday programs, delivered by RBG staff and others.

(Moors, 2006)

In defining the streams of Sustainable Gardening and People, Plants and Culture the working group acknowledged the programs currently being delivered by organisations such as community groups, Friends groups and education and training organisations. It became clear that developing long term strategic partnerships with some of these organisations would be a very effective way for the RBG to achieve its community engagement objectives.

The RBG has recently developed an event based on a partnership approach with RBG tenants and Friends of the RBG called Spring Open Day. This event can be held up as a working example of how effective partnerships with supporter groups such as the Friends can be used to achieve the objectives of the RBG.

Inception of Spring Open Day

In early 2003, the Visitor Services branch of RBGM was looking to develop a vehicle to build awareness and appreciation for the work of the Royal Botanic Gardens and inspire new visitors to come and experience the Gardens.

On any given weekend, there is a multitude of events and tours available to visitors in the Gardens. These events and tours are offered by a variety of groups. A typical Sunday in the Gardens may see

Plant Craft Cottage holding a plant weaving workshop, Friends of the RBG providing a lecturer on Landscape Design, the Visitor Centre promoting guided walks and the Gardens shop organising botanical illustration demonstrations or a musical performance by the resident harpist. It was through looking at these activities that the idea for a new RBG event was born. The philosophy behind Spring Open Day is to co-ordinate all these activities under the one umbrella and produce an event that will benefit all stakeholders while achieving Visitor Services' overall objective of new visitors to the Gardens and an increased profile and appreciation for the work of the RBG.

Visitor Services Branch agreed that the logic behind the event was sound and there was general support for the initiative from senior management. However, the multitude of stakeholders and wide ranging logistical considerations meant that the developmental phase of the event would require significant effort. A major challenge facing Visitor Services staff was to change the way stakeholders viewed other events in the Gardens. Initial meetings with stakeholders focussed on selling the benefits of having a multitude of events and activities for visitors. Supporter groups and RBG tenants needed to be convinced that a coordinated approach could not only generate higher and longer visitation, but that it would result in a better outcome for their particular event. In consultation with stakeholders a marketing plan with a particular focus on media contact was developed. The plan was an operational document but it also greatly assisted in gaining support for the event. Instead of competing for the same audience, stakeholders could see the benefit in attracting visitors with a range of activities that constitute a day out rather than an isolated activity.

To support the goal of attracting new visitors to the Gardens, a deliberate strategy of utilising entertainers from different backgrounds was employed. Local school bands were invited to perform on the Dunlop Plaza and a jazz band consisting of students from the Victorian College of the Arts was hired to perform on the one of the lawns. Through these interactions, the RBG was able to engage with younger members of the local community and diversify its potential audience.

The proposed program for Spring Open Day featured a variety of free walks and tours delivered by Voluntary Guides. These walks would provide members of the public with an opportunity to see areas of the Gardens normally closed to the public. The Nursery and National Herbarium of Victoria would be open for regular tours booked through the Visitor Centre. This element of the event was aimed at increasing the awareness of the work of the RBG.

For the Spring Open Day to be a true partnership with stakeholders, the RBG recognised that for tenants such as the Observatory Café and Terrace Tearooms participation in the event needed to make business sense. This also applied to fundraising areas of the RBG such as the Gardens Shop and even the Friends of the RBG who raise funds through plant sales twice a year. Naturally, it was these stakeholders who wanted to know how activities on Spring Open Day would impact their bottom line. To support these stakeholders, it was decided all the guided walks should conclude at the Friends plant sale. Botanical Illustration demonstrations would be situated in the Gardens Shop and musical entertainment would be positioned near retail outlets. These initiatives coupled with the predicted increase in media exposure were well received by stakeholders and all were keen to be involved.

The inaugural Spring Open Day was held on Sunday 12 October 2003. The media interest in the event was better than expected and included television coverage, radio interviews, editorials in the major newspapers and event listings in many local newspapers. This coverage was achieved through a long lead media release, and media releases just prior to event. The majority of walks and tours were fully booked, RBG tenants reported increased business and the Gardens received overwhelming positive feedback on the Open Day concept from visitors.

In 2004, the RBG's energies were directed towards the opening of The Ian Potter Foundation Children's Garden and it was decided to wait until 2005 for the next Spring Open Day. The positive experience of the first event saw many of the stakeholders increase their involvement in the 2005 event. A snapshot of statistics and feedback from stakeholders is provided below:

Snapshot of Results: 2005 Spring Open Day

- Highest ever recorded sales at the Growing Friends Plant Sale
- Hundreds of visitors enjoyed live music at two sites in the Gardens
- 220 visitors participated in walks and tours
- Gardens Shop sales were 20% over budget for the day
- Total of 6,500 visitors in the Gardens. (Average daily visitation for October is 3,235 visitors)
- Both the Observatory Café and Terrace Tearooms reported increased sales on the day

The RBG has secured sponsorship to the value of \$5,000 from the City of Melbourne for the 2006 Spring Open Day. This sponsorship is part of an event partnership program that will see the RBG and City of Melbourne working in collaboration to promote the event. All stakeholders have confirmed their participation in this year's event and the program of entertainment, walks and tours has been expanded in anticipation of increased interest from the public.

Conclusion

The new Community Engagement Framework provides purpose and direction for the activities of the RBG over the short to medium term. Connecting people with plants is about facilitating engagement of a more diverse audience at both RBG Melbourne and Cranbourne. It is through this engagement that the RBG will achieve greater relevance to more of the community.

The Spring Open Day is an example of an event that has succeeded in engaging new visitors and raising the awareness and appreciation of plants and the important work of the RBG. This has been achieved by developing partnerships with key stakeholders that reflect the needs of all parties.

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Engaging a diversity of schools in the Royal Horticultural Society (RHS)

Dr. Jacqueline Chave

RHS Garden Wisley, Surrey, England

Introduction

The RHS Education Department works with schools in many ways. Each of the four RHS gardens hosts school visits, the RHS schools membership scheme provides schools with regular information and advice regarding gardening in schools, Continuing Professional Development days encourage teachers to set up gardens in their schools and to incorporate gardens into their teaching.

Flourish, the RHS campaign for the growing generation, started in autumn 2004. It is currently working on a project called 'Grow it Cook it' in association with the Open Futures campaign, whereby two trained horticulturists work with schools assisting them to set up food-producing gardens. Focus on Food, a partner, then works with the schools on developing essential skills to cook the produce. The aim of the project is to encourage children to choose healthy foods and to enjoy cooking meals with fresh ingredients from scratch.

In each of these the RHS is aiming to reach as many schools as possible and to widen the diversity of schools involved in their programmes. Over 4000 schools, of all types across the British Isles, are registered with the RHS schools membership scheme and the CPD programme includes days on 'Using the school grounds with Special Educational Needs pupils' and operates throughout Britain. The Flourish project selects schools to work with that are in deprived areas, the first ten are on the South coast. In autumn 2006 two more horticulturists will be working with ten schools from the Leeds and Wakefield areas.

This paper examines ways that the RHS programme for school visits will be developed to encourage a larger variety of schools to come to their sites.

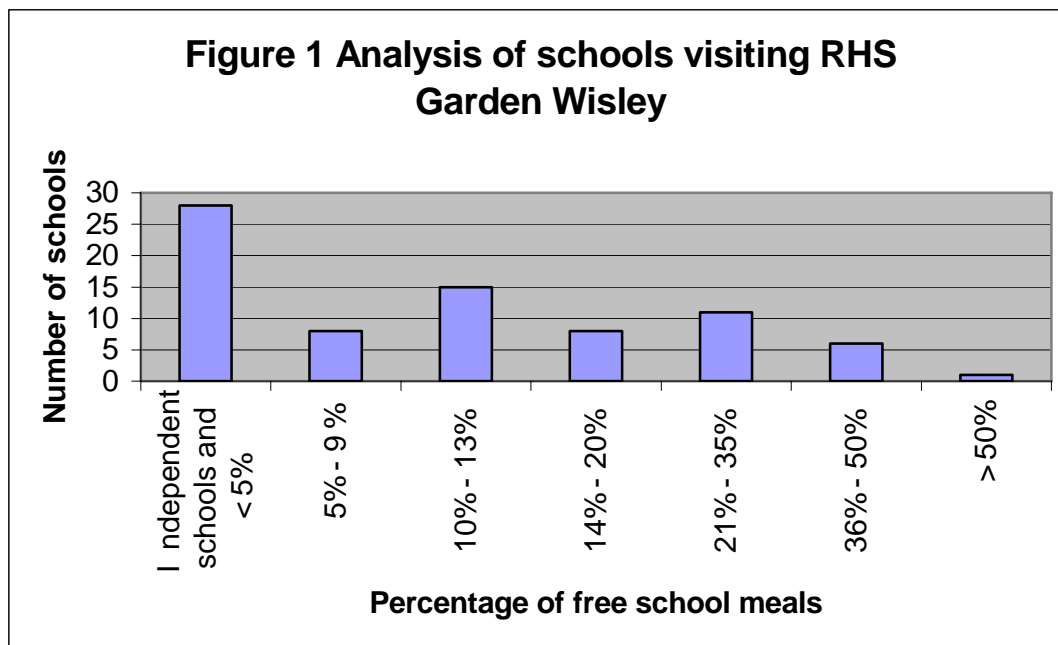
Background to school visits

The RHS has been hosting school visits formally since 1995 at RHS Garden Wisley. Currently all four RHS Gardens have their own Education Officers leading school visits. In the academic year 2004-2005 approximately 10,000 children visited one of the four RHS Gardens. School visits have also been held at RHS Flower Shows and in the Lindley Library (Head Office, London).

School visits around RHS Gardens place children in direct contact with a wealth of practical horticulture, specialist knowledge and the sheer beauty and range of plant diversity. They are an ideal way to increase a child's interest and enthusiasm for growing plants. With exciting activities linked to the National Curriculum, designed to capture and engage young minds, school children are actively invited to learn more about plants, gardens and the natural environment. The 'germination game', for example, investigates the conditions required for germination in a stimulating and interactive way.

The RHS programme for school visits gives children the opportunity to learn ‘outside the classroom’ which has many benefits. Learning outdoors requires a different thinking process, often resulting in knowledge and skills being retained for longer. It is generally recognised that pupils learn best from hands-on experiences, from seeing and hearing, handling, measuring and investigating the ‘real world’ for themselves (DfEE 1997). Research shows that students find lessons outdoors more relaxed, interesting and easier to understand. The outdoor classroom improves students’ motivation, personal and social skills, such as patience, caring, respect, co-operation, teamwork and the ability to work independently. Learning outside increases self-esteem, self-confidence, a sense of well-being and provides inspirational experiences along with awe and wonder. Learning outside provides a framework for knowledge and understanding about the natural world, biodiversity and sustainability. Evidence has shown that landscape and nature can influence emotions, health and behaviour. Outdoor activities help keep students fit and healthy, both physically and mentally. Students with learning difficulties, in particular, have been seen to gain confidence and to be more motivated through working outdoors (Smith and Aldous 1994). Visiting gardens give students an insight into food production and seasonal produce.

An analysis of the type of schools that visited RHS Garden Wisley in Surrey, was carried out for the academic year 2004-2005. (In Britain the percentage of children receiving free schools meals is a crude way of assessing the level of disadvantage amongst children that attend the school).



A large proportion of visiting schools are either independent or those with a low percentage (<5%) of children receiving free school meals (Figure 1). There is a large number of schools with a high proportion of children from relatively affluent families that visit Wisley. To some extent, this reflects the social balance of the immediate area. It is, however, a matter of concern when schools reflecting other community profiles are known to lie within visiting distance. The RHS would like to see a more diverse range of schools visit their gardens and is committed to giving as many school children as possible the opportunity to experience a visit.

RHS Action Plan

1. Within the 'catchment' area of each garden, state schools will be identified that do not presently visit. The RHS currently has four gardens: RHS Garden Wisley in Surrey, Rosemoor in Devon, Hyde Hall in Essex and Harlow Carr in North Yorkshire. Wisley lies in a very densely populated area of the South East with schools in both Surrey and South West London within easy reach. Inner London schools are close enough to travel to Wisley, however, it would be more appropriate for them to use venues that are nearer to them. Wisley should concentrate on schools in deprived areas in the county of Surrey (Woking and the London side of the M25), parts of 'Middlesex' and South West London. Schools visit RHS Garden Rosemoor from most of Devon, North Cornwall and occasionally Somerset. This area contains some rurally deprived areas often with very small schools and also deprived areas in some of the larger towns such as Barnstaple, Exeter and Bideford. The catchment area for RHS Garden Hyde Hall includes Essex and East London (Barking, Dagenham, Ilford and outskirts of Romford). Essex has rural communities that are generally not deprived, large towns such as Basildon and Southend that have pockets of deprivation and East London boroughs including large council estates.
2. Contact will be made with the schools that do not visit RHS Gardens and in liaison with these schools issues will be identified that have prevented them from making visits in the past. In a recent report by the Department for Education and Skills (DfES) (Education and Skills committee 2005) the following issues were identified that deter schools from making visits: perceived risk associated with outdoor education, cumbersome bureaucracy, funding, time and resources.
3. Experience and knowledge gained from successful school visits will provide guidance and support for non-visiting schools. This will assist with overcoming barriers enabling the RHS to offer an attractive educational package. Financial constraints will be addressed by helping schools access funding sources.
4. Local Education Authorities will be approached to ensure that RHS school visits are effectively integrated with other outdoor education providers.
5. Visits to schools by RHS Education Officers will be key to the promotion of the programme amongst teachers and children. These visits may include talking to staff and governors during meetings, giving assemblies or teaching groups of children to demonstrate the type of activities available at RHS Gardens and finding out the type of activities the schools may want from such a resource.

Progress

During the academic year 2004-2005 there were 138 'school visits' to Wisley with 4405 children, representing 86 different schools. RHS Garden Wisley is within a densely populated area with 54 primary schools within a radius of 5 miles, rising to 236 primary schools within a radius of 10 miles. At the moment only 36% of this number come to the garden. Only a handful of Secondary schools have visited within the last few years. If schools are prepared for up to one hour's travelling time then RHS Garden Wisley could be attracting schools up to at least a distance of 30 miles away.

There are 170 schools within one and a half hour's drive of RHS Garden Rosemoor. Thirteen schools within one hour's drive have never visited (16%) and 45% of the schools that are one to one and a half hours' drive have never visited. Those that visit include state, independent and special schools for 3-11 year olds in Devon, a handful of Cornish schools, as well as a few colleges, sixth forms and Devon Curriculum Services.

In 2006 two new programmes were introduced to encourage schools that had not visited RHS Garden Wisley to visit. During the BA (British Association for the Advancement of Science) National Science week in March 2006 two days were set aside for specific science activities for schools. One day was dedicated to secondary schools and a further day to primary schools. On both days schools were selected and invited based on their location. The secondary school day allowed students from two schools to spend the day working with RHS horticultural scientists, ranging from soil scientists to entomologists. Healthy schools days were set up in collaboration with local primary care trusts and the healthy schools campaign. Four days were organised, two for London schools and two for Surrey schools. Once again, eight schools were invited based on information from the primary care trusts. The aims of these days were to challenge existing attitudes in children towards eating fresh fruit and vegetables and to awaken their interest in the variety and flavour of fresh produce.

Limitations

Limitations include the lack of indoor space for hosting school visits and the availability of Education Officers. Although it is important that school children spend as much time as possible outside whilst on a school visit, an indoor space to leave their lunch and coats and in case of rain is necessary.

When running both the science days and healthy schools days some schools were contacted on many occasions before responding and others never did respond. Schools found it a problem covering the transport costs even though visits are free.

A very late cancellation from one school for the healthy schools days indicated their lack of commitment and severely affected the organisation of the day.

Future plans

The appointment of an additional Schools Education Officer at Wisley in August 2006 will permit development of a programme to attract a greater variety of schools to Wisley. All experience gathered at Wisley will be disseminated to the other RHS Gardens for the programme to be implemented across the RHS.

A new position of Science Education Officer, to develop and manage a science education programme, addressing the 11-19 school curriculum and the public understanding of science, is in process. The programme will be developed (i) nationally, to engage the widest UK audience, and (ii) through RHS Gardens, and the Learning Centre at Wisley in particular. This will encourage a presently under-represented audience of secondary schools to RHS gardens.

The RHS Garden Wisley has a new Learning Centre, incorporating a classroom, a growing lab and a teaching garden due to open in 2007. This along with the second Schools Education Officer at Wisley will allow an increase in the availability of school visits together with exciting new learning opportunities. RHS Garden Harlow Carr also has plans to build a new Education

Centre and both RHS Garden Rosemoor and Hyde Hall have plans to develop their educational resources.

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Biography

Jacky Chave is the Principal Education Officer (School & Family Learning) for the Royal Horticultural Society (RHS) based at RHS Garden Wisley, Surrey. The work of the School and Family Learning team includes leading school visits at the four RHS Gardens, managing a national programme of Continuing Professional Development days for teachers involved with gardening in schools, and running a Schools Membership Scheme.

The feasibility of employing landscape narrative in improving education functions in botanic gardens

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Abstract

Interpretation is a way of sending relevant information to visitors and also an important interface for people to take message. Successful interpretation in botanic gardens allows concepts and action on natural resources conservation can be delivered and extended to visitors, which would in turn help the implement of conservation administered by botanic gardens authorities and fulfill the mission of education.

HengChun Tropical Botanic Garden was chosen as the site for this research. Based on the cognitive psychology theory, landscape narrative is employed in an interpretation program using computer simulated films to examine their effects on acquiring messages by primary school pupils. The results indicate that interpretation through narrative landscape can raise attention and gain better performance of pupils in subsequent learning evaluation test.

This empirically study can be referred as a successful model of landscape narrative and applied on the design and management of botanic gardens to improve the effectiveness of interpretation plans. If the content of oral interpretation is well linked and matched with “interpretive landscape”, the learning efficiency could be enhanced accordingly.

Keywords: interpretation, landscape narrative, interpretive landscape, botanic garden

1. Introduction

Botanic gardens play an important role in conservation of plant and natural resources, research and education, particularly environmental education. Botanic gardens are also regarded as one of the best sites for recreation.

Interpretation has been a major service for visitors in recreational sites and museum in many countries. Without interpretation a botanic garden is little more than an attractive park (Giffurida, 1996). The aim of interpretation service is to convey message to visitors in order to enhance visitors’ understanding to the site. Recently a new approach “Narrative display” has been incorporated into Clothing Culture exhibit design for revealing a concept or a theme (the University of Manchester [internet]). In other words, the approach use story telling technique to arouse the visitors’ interest and curiosity. As people have lots of experiences of listening stories, it seems easier for people to take messages and remember them under such an approach. The efficacy of narrative landscape design on learning as an aid of interpretation in botanic gardens has not been explored yet, however.

Various narrative elements associated with the plants displayed in Hengchun Tropical Botanic Garden were simulated to investigate whether narrative landscape design can improve the efficacy of learning or not in this research. The results would be valuable for designing display areas of botanic garden in terms of improving their educational functions.

2. Literature Review

2.1 The plant display of botanic gardens

The plant display area is the fringe of botanic gardens to contact visitors and also the main “channel” to disseminate message. The themes displayed are diverse including plant science, ecology, genetics and allied subjects. Whether the plant display is indoor or outdoor, the setting of display area is usually according to plant taxonomy, evolution, geographical distribution, ecology, utilization, or combinations to create (Lai, 1993). In some thematic display gardens, such as the Evolution House and the Japanese Garden of RBG, Kew and several thematic display of Eden Project (Fig 1), landscape narrative has been added into design to form interpretive landscape. Such a narrative landscape seems to attract more visitors’ eyesight and arouses their interests. However, the efficiency of sending message could be enhanced or not remains uninvestigated.



Fig 1. Application of landscape narrative on thematic displays in the Eden Project (Chang, 2002)

2.2 Interpretation in botanic garden

Interpretation in botanic gardens could be regarded as a medium to demonstrate the efforts that the staffs have made or what the garden contains, whether on research, conservation, education or amenity value, to the public. Through interpretation, visitors can feel or understand what knowledge or messages the educators of botanic gardens are trying to deliver or disseminate. High quality interpretation is regarded more effective in conveying messages due to more pleasurable, relevant, organized and thematic nature (Chang, 2001). Thus, interpretation needs

professional knowledge and skill in order to help people to appreciate something that you feel is special and to share enthusiasm about a place or subject so that your visitors will find it interesting (Carter, 1997).

However, Oikawa (2000) pointed out that only a small fraction of the total number of visitors to botanic gardens take some form of education programme. More innovative strategies need to be offered in botanic gardens to attract and educate as widely a spectrum of audiences as possible.

2.3 Association of landscape narrative and interpretation

Narrative is a series of events take place at certain places during a period of time. These events have cause-result relationship, i.e. “story”, are usually described through visualized processes (Bordwell and Thompson, 2003). Through the aid of a “story”, the information to be delivered could be understood through narrative setting associated to story line. Potteiger and Purinton (1998) suggested that the objects of narrative exist in landscape as well. Narratives intersect with the landscape, and belong intrinsically to the materials and processes of the landscape. The shared relationship and interplay between narrative and landscape develop and engender stories in many ways. Therefore the association of landscape narrative and interpretation would be worth of investigation.

In botanic gardens, narrative may or may not exist when the landscape was formed, although there was always various plants embody stories. The design of narrative in the sites where interpretation should take place would allow interpretation to be conducted fluently and tourists can appreciate and acquire knowledge simply by visiting the sites. Such an approach may be referred as interpretive landscape, which is designed to tell specific stories (Chang, 2002).

Besides, association and reference type of landscape narrative create scenes that connect with visitors through experience, event, history, or religious allegory, may also enhance the perception, cognition and experiences. It would be beneficial for landscape designers and educator to create a thematic display if the influence of narrative landscape on acquiring knowledge can be evaluated scientifically. The study attempts to examine the learning efficiency of pupils in a simulated guided tour in narrative landscape setting and tries to deduce principles (guide lines, formula) in the design of theme display in botanic gardens to improve their education and recreation functions.

3. Research methods

3.1 Site selection – the targeted botanic garden and its thematic gardens

Hengchun Tropical Botanic Garden, established in 1901, was selected as the target garden in this research. In the ‘National Botanic Garden Network Plan’ proposed by government authority of Taiwan in 2002, the garden was selected to improve the landscape to fulfill the multi-functions set up by government.

The theme gardens for computer simulation were selected after interviews with volunteer guides and staff. Five theme gardens recommended included: 1) white Ficus (*Ficus benjamina* L.) Display, 2) Looking-glass tree (*Heritiera littoralis* Dryand) Display, 3) Indian barringtonia (*Barringtonia asiatica* L.) Display, 4) Lanyu Display and 5) Taiwan Ethnobotany Display.

3.2 Design of experiment

In order to evaluate the influence of narrative landscape on the learning efficiency of pupils, the scenery of five theme gardens selected were recorded by video camera (JVC GR-D230 digital camcorder) respectively on the sites. Narrative elements were simulated and integrated in the film. The types “association and references” indicate that the elements added in the display area are created by human or related to the plants. The natural type of landscape narrative in this research refers to elements that express significant phenomenon of natural processes.

Computer simulated scenes include the entwist root, buttress root, sculpture of Barrington flower and fruits, wooden canoes and aboriginal houses were added in each of the films as the experimental narrative landscape to contrast with the control (un-modified film) treatment. The same interpreting information was orally presented along with the control and the experiment film to resemble a guide tour on the scene as they are visiting the theme gardens.

The 5 experimental narrative landscape treatments were randomly assigned into film A and film B (Table 1). The respondents, a class of pupils, were randomly divided into two groups by drawing number, one group viewing film A and the other seeing film B. A structured questionnaire was designed to test how interpretation information was gained by comparing experimental and control treatments. All the films were played sequentially in the audio room of school.

3.3 Selection of respondents for questionnaire survey

8 of the 68 elementary schools of Taichung city were randomly sampled. One class of both the third and fourth grade of the sampled school was chosen following random sampling process. The total number of sampled pupils was around 2% of the same age population in Taichung. The third and fourth grade pupils (age 9-10) of elementary schools were chosen for that they are generally curious and able to respond to more complicated text. Interpretive information of each theme delivered in this research was approved not learnt before in the curriculum by their teachers.

The experiment was conducted during September to October, 2005. Pupils of the same class were randomly divided into 2 groups. One group of students watching film A and the other group watching film B. After watching the film, 2 groups of students answered the same questionnaire. The overall time needed was approximately 30 minutes.

3.4 Questionnaire design

The sample profiles include gender, level of interests on plant related knowledge, and whether they have visited HengChun Botanic Garden or not, were collected to compare their differences.

Questions for evaluating learning efficiency were designed according to the information to be delivered corresponded to each theme. Four questions (Table 2A-2E) for each theme are designed, in which 2 questions are associated with the narrative landscape and the remaining 2 questions were not. In white Ficus Display, only 1 question was associated with landscape narrative.

3.5 Statistical analysis

The Statistical Package for Social Science (SPSS v. 10) was used to analyze the collected data. The χ^2 test, t-test and was used to test hypothesis for significance between the experiment and control treatment at a 0.05 significance level.

4. Results

4.1 Profiles of respondents

The homogenous analysis indicated that there were no differences detected on the profiles of respondents. The proportion of gender distribution in two groups was rather homogenous ($P = 0.438$, Table 3A). Proportion of the two group respondents who had been to HengChun Botanic Garden was similar ($P = 0.322$, Table 3B). No difference was observed on the distribution of preference on plant related knowledge ($P = 0.569$, Table 3C).

4.2 Effects of landscape narrative on learning efficiency

The results, presented in Table 4 showed that the average performance was higher in each of the five narrative landscape experiments than the control. Apart from the Indian Barrington Display, wherein the probability was 0.012 ($P < 0.05$), the remaining landscape narrative treatments significantly increase the performance ($P < 0.01$).

In contrast, the performance of students on questions not associated with landscape narrative of each theme was not different (Table 5). The results confirmed that the narrative landscape scenes only increase the score of associated questions, while have no apparent effects on non-associated questions in this study.

4.3 The visual attributes and preference of the narrative landscape

The 5 narrative landscape employed in this study (Table 2) utilized natural elements (white *Ficus* and Looking glass tree) or men made objects (Indian barringtonia sculpture, canoe, cottage) to compare the effects of narrative landscape on learning efficiency. It is interested to know whether such narrative objects added in landscape would influence the visual preference or not. As in the experiment, the theme display *Ficus benjamina* and Looking glass tree used different background scene to deliver the information, there is no basis to compare the influence of narrative objects added in the landscape as a consequence. Therefore the effects of narrative objects on visual preference were compared on themes with the same background.

On the visual preference, it is shown that when narrative objects were added into the simulated scenes, the degree of attractiveness, interests, and preference were almost all significantly enhanced (Table 6) except the degree of preference on Indian Barringtonia Display was not affected ($P = 0.19$).

5. Discussion and conclusion

It has been suggested that audiences or visitors at a public site, whether they are facing a panel or an interpreter, may pick up messages that they are interested in. This is sometimes called

selective attention by psychologists (Ham, 1992). In this study, two types of narrative landscape, interpretive landscape and the association and reference, were incorporated and both showed substantial improvement on learning, which is also corresponded to the attractiveness, interests and preference. In Lanyu Display, the colorful wooden canoes, which are recognized as one of the most representative features of Lanyu, showed the most significant effects ($P = 0.001$) on both learning (Table 4) and attractiveness (Table 6). The results may infer that if the narrative elements show obvious characteristics, it not only could arouse the attention of students but also was it imprinted in memory through the pattern and signage recognition process of brain and associated information was taken naturally, the effectiveness of learning was also significantly improved as a consequence.

It was also demonstrated generally that if objects for the creation of narrative environment were integrated in landscape, the degree of attractiveness, interests and preference was greatly enhanced. The impression of respondents on the scenes might be increased. It would be worth of investigation on whether information related with the narrative landscape can be remembered for a longer duration or not.

From aspect of cognitive psychology, environment information can be delivered efficiently if it is delivered from both vision and listening (Li, 1990). The strong support of landscape narrative in enhancing education function of botanic gardens shown in this study can be used in the design and manage landscape of botanic gardens. It is suggested that the managers of a botanic garden could screen the special features and scenes from the resources it has, set up thematic landscape and effective content of interpretation, to obtain the best effects of delivering message. Narrative landscape could be designed and integrated into the environment according the topic of display. The narrative landscape can be simulated and evaluated following the procedures reported in this study to ensure the narrative landscape is effective in terms of improving learning efficiency.

Acknowledgement

The authors wish to thank the National Science Council for the generous grant (project code: NSC93-2313-B-324-003). We would like to express our gratitude to Dr. Hsiang-hua Wang, Dr. Fuh-jiunn Pan, Dr. Ho-yih Liu and Ms. Shu-hui Wu for their suggestions and assistance over the development of this study.

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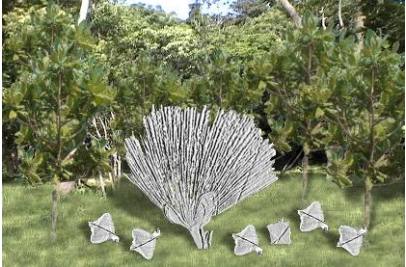

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Table 1. Selected theme Display to simulate narrative landscape and variables

display area Item	Ficus benjaminca Display	Looking glass tree Display	Indian barringtonia Display	Lanyu area Display	Ethno-botany Display
Types of landscape narrative	Association and Reference / Interpretative Landscape				
Narrative elements	Natural scenes		Designed scenes		
Experiment treatment	Obvious entwist root (Film A)	Obvious buttress root observed (Film B)	Flower and fruits of Barringtonia presented (Film A)	Wooden canoe presented (Film A)	Aboriginal house presented (Film B)
Control	No entwist root observed (Film B)	No narrative objects presented (Film A)	No narrative objects presented (Film B)	No narrative objects presented (Film B)	No narrative objects presented (Film A)

Table 2. The theme displays and questions.

A. <i>Ficus benjamingca</i> Display	
Experiment treatment	Control
	
<p>Non associated questions:</p> <ol style="list-style-type: none"> 1. What is the color of the trunk of <i>Ficus benjamina</i>? 2. What are the functions of the aerial roots? 3. What would the aerial roots become? <p>Associated question:</p> <ol style="list-style-type: none"> 4. The supporting root of white <i>Ficus</i> may wind around the plant it attached and cause the death of host plant, what is the phenomenon called? 	
B. Looking glass tree Display	
Experimental treatment	Control
	
<p>Non Associated questions:</p> <ol style="list-style-type: none"> 1. What are the functions of buttress roots? 2. In which climatic zones can plant develop such type of root? <p>Associated questions</p> <ol style="list-style-type: none"> 3. In order to adapt to the hot, humid and shallow soil environment, the shape of some plants become? 4. Which of the following plants show typical planar root type? 	

C. <i>Indain Barringtonia</i> Display	
Experiment treatment	Control
	
<p>Non Associated questions:</p> <p>1. When does the flowers of Indian Barringtonia bloom in a day? 2. Where can we find the plant of Indian Barringtonia?</p> <p>Associated questions:</p> <p>3. How do the locals of Hengchun describe the fruits of Indain Barringtonia? 4. How many stamens are there in a flower of Indain Barringtonia?</p>	

D. Lanyu Display	
Experiment	Control
	
<p>Non associated questions:</p> <p>1. What original name does the aborigines of Lanyu advocate to change back? 2. What is the most important activity in Lanyu in June?</p> <p>Associated questions:</p> <p>3. What do the aborigines sail to the sea to catch fishes? 4. Which plant is used to make the keel of the canoe?</p>	



E. Ethnobotany Display	
Experiment	Control
	
<p>Non associated questions:</p> <ol style="list-style-type: none">1. What materials did the aborigines of Hengchun Peninsula use to make cloth before the 17th century?2. What plant materials did the aborigines use to construct roof beam of the cottage? <p>Associated questions:</p> <ol style="list-style-type: none">3. Which subject study how people use plants in their daily life?4. What materials did the aborigines use to cover the wall of their cottage?	

Table 3. Profiles of respondents of this research

A Distribution of gender					
	gender			total	Chi test
	male	female			
A group	111	98		209	$\chi^2 = 0.614$
B group	105	108		213	$P = 0.438$

B Visit HengChun Botanic Garden or not					
	have visited			total	Chi test
	Yes	No			
A group	27	182		209	$\chi^2 = 0.980$
B group	21	192		213	$P = 0.322$

C Preference of respondents on plant related knowledge					
	Degree of preference			total	Chi test
	not interested	neutral	interested		
A group	63	51	98	209	$\chi^2 = 2.935$
B group	53	66	94	213	$P = 0.569$

Table 4. Effects of landscape narrative on learning efficiency – questions associated with interpretative landscape.

Thematic display	Average score ^a		T-test	
	+ ^b narrative (N) ^c	- narrative (N)	t value	P value
White <i>Ficus</i> Display	79.9 (209)	67.3 (213)	2.95** ^d	0.003
Looking glass tree Display	47.6 (213)	37.5 (209)	2.71**	0.003
Barringtonia Display	58.8 (209)	49.7 (213)	2.51 *	0.012
Lanyu Display	47.3 (209)	39.2 (213)	3.36**	0.001
Ethnobotany display	50.0 (213)	40.9 (209)	2.78**	0.006

a: Average score of 2 associated questions, 1 or 2 correct answer was scored 50 or 100, respectively.

b: +, - indicated the presence or absence of narrative objects in film, respectively.

c: N, total number of respondents

d: *, **: significant at 5% and 1% level.

Table 5. Effects of landscape narrative on learning efficiency – questions not associated with interpretative landscape.

Thematic display	Average score ^a		T-test	
	+ ^b narrative (N) ^c	- narrative (N)	t value	P value
White <i>Ficus</i> Display	65.2 (209)	65.2(213)	0.006	0.996
Looking glass tree Display	78.2(213)	78.5(209)	0.108	0.914
Barringtonia Display	41.1(209)	45.5(213)	1.204	0.229
Lanyu Display	65.3(209)	63.1(213)	0.624	0.533
Ethnobotany Display	73.7(213)	73.4(209)	0.077	0.939

a, b, c, d, : refer to Table 4.

Table 6. The effects of interpretative landscape of 3 thematic display on attractiveness, interests and preference^a.

Thematic display	Landscape narrative (n)	Attractiveness	Interests	Preference
Barringtonia Display	With (209)	3.98	3.89	3.9
	Without (213)	3.7	3.62	3.74
	t	2.255	2.146	1.303
	P	0.025	0.032	0.193
	Significance ^b	*	*	N.S.
Lanyu Display	With (209)	4.16	3.95	4.02
	Without (213)	3.65	3.6	3.62
	t	4.045	2.700	3.908
	P	0.000	0.007	0.002
	Significance	***	**	**
Ethanobotany Display	With (209)	3.99	3.91	3.9
	Without (213)	3.68	3.57	3.59
	t	2.660	2.875	2.568
	p	0.008	0.004	0.011
	Significance	**	**	*

a: The score given is from 1-5

b: NS, *, **, ***, denote non-significant, 5 %, 1 %, and 0.1 % level of significance

Raising public awareness about forest plants and ecosystems at the Makiling Botanic Gardens, Philippines

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The Makiling Botanic Gardens (MBG) was established by Presidential Proclamation 60 on 30 November 1920 and later by Republic Act 3523 dated 20 June 1963 to “support professional instruction and research relating to forestry and plant sciences and to serve the educational and recreational needs of the general public.” Under the operational management of the University of the Philippines Los Baños (UPLB), MBG aims to promote appreciation and to increase knowledge and understanding about plants, their diversity, importance and conservation. Its 300-ha area features a living collection of endemic and exotic flora and a repository and sanctuary of endangered plant species of the country. It serves as an important outdoor laboratory for the advancement of scientific knowledge on rainforest ecology and biodiversity conservation.

Located at the lower slopes of the Mount Makiling Forest Reserve and just 65 km southeast of Manila, MBG receives an annual average of 150,000 foreign and Filipino visitors. Majority of its visitors are students and teachers of high schools and colleges from and around the country’s capital.

MBG has facilities and services for visitor inquiries, reception, orientation-briefings, and audio-video presentations. Brochures, flyers and posters are made available to the general public.

Visitors can avail of the services of UPLB ENTs or Educators for Nature Tourism are students of the University of the Philippines - Los Baños who were trained to provide guided walk and nature interpretation services to the visitors of the Makiling Botanic Gardens (MBG). Their mission is for the visitors to understand and appreciate natural places, especially rainforests like Mt. Makiling, while enjoying it.

This conservation education program encompasses six modules delivered through a video show and a two-hour walk around MBG. The first module is about the values and conservation status of tropical rainforests. The second module concerns the characterization and classification of plants according to habitat and taxonomic groupings. The “TreeWorld” is the third module that covers a discussion on the economic importance of trees. For instance, almaciga (*Agathis philippinensis*) is a natural source of varnish, while betis (*Madhuca betis*) lumber is good for furniture and shipbuilding. In the fourth module, common queries like “Why dipterocarps grow tall?” and “Why there are invasive trees?” are tackled. An introduction to the world of raptors - eagles, hawks, falcons, kites, buzzards, and owls – follows through a visit to the Center for Philippine Raptors. The last module teaches visitors about watershed values of mountains and the ecological connection between Mt. Makiling and Laguna de Bay.

The ENTs also remind the visitors about MBG's house rules like refraining from picking any flowers, fruits or seeds, vandalism, littering, and others. MBG receives an annual average of 150,000 visitors mostly high school students from Metro Manila and Southern Tagalog regions.

While visitors benefit a lot from the discussions, the ENTs themselves also gain from their task. Aside from earning money that they can use for their daily school expenses, their presentation and speaking skills are also honed. Advanced booking is required to avail of their services.

UPLB forestry students and volunteer faculty and staff members are serving as cogents who provide guided walks and nature interpretation services upon request. Current learning modules put emphasis on Philippine flora, rainforest ecology, Philippine raptors, and riverine habitats.

Conservation education and information are also delivered through the following projects and activities: annual biodiversity training course (BIOCAMP) for science teachers and community leaders, youth ECOCAMP, summer nature encounters, nature arts classes, annual Arbor Day and Festival of Trees events.

MBG is expected to further play a prominent role as a nationally and globally significant conservation education area and as a convenient site for nature-based outdoor recreation and ecotourism.

Raising awareness of alpine plants

Mr. Costantino Bonomi, Plant Conservation officer

Viotte Alpine Botanic Garden, c/o Trento Natural History Museum, Trento, NE Italy

Introduction

Since 1998 Trento Natural History Museum, based in north east Italy, planned and designed education activities in its two botanic gardens especially focused on alpine and mountain plants. In the past 8 years these activities have been constantly updated in their content and formats and also in part renewed. The main aim has always been to raise the awareness on the importance of plants for our daily life, on the various threats that endanger them in the wild at the moment and on what ordinary people can do to help and save them. As a general rule these activities tried to engage the visitors making use of popular games and quests re-designed and re-formatted with a botanic content (treasure hunts, mastermind, domino etc.). Then they moved on to involve the participants in hands on experiences that required direct interaction with plants or plant derived products with a creative side to it (preparing plant-made gifts, paintings, bags, dishes, pots etc.). Finally the event concluded with a message on plant sustainable use and its importance for the future of humankind. This paper will present a selection of the most successful activities developed over the past years and will simulate the creation of possible new activities using the same successful format.

Location and technical details

Trento Natural History Museum manages two Botanic Gardens: `Viotte` Alpine Botanic Garden , 1540 m high, on Mt. Bondone near Trento (Marchesoni 1962, Pedrotti 1992, Pedrotti & Da Trieste 1998, Tisi 1993, Tisi 1999a, Tisi 1999b) and Arco Arboretum 91 m high 5 km north of Lake Garda (TISI 1996, TISI & LARCHER 1997). Both gardens are located close to popular tourist resorts. The educational games illustrated below are held weekly in Trentino Botanical Gardens from July to September: they last for approx. 3 hours and are offered to ordinary visitors, particularly children, families and elderly people as well as to organized tour groups such as summer camps, cultural clubs and societies. The offer is also included in the programmes of the local tourist information office.

A 'Botanical Treasures' Hunt

This is basically a non-competitive game as each team follow parallel routes and eventually ends up with a treasure. Each team is requested to pass a certain number tests (usually 5 or 6) to get all the pieces of the treasure map. 6 different maps will lead each team to find a treasure in 6 different locations. These tests include different botanical questions or demonstrations that can be varied according to season and garden specificity. General tests often employed include painting a plant drawing, matching the seed with the right cone, matching the plant with the product derived from it, recognising blindfolded the bark of a tree or the smell or the taste of a plant, preparing perfumes, oils and creams in a dedicated session, look at mysterious objects and try to find them around the garden, learn to distinguish poisonous and edible plants such as the medicinal yellow gentian (*Gentiana lutea*) from the poisonous false hellebore (*Veratrum album*), the tasty true blueberry (*Vaccinium myrtillus*) from the tasteless bog blueberry (*Vaccinium uliginosum*) (Fig. 1). When all these requirements are fulfilled, all the pieces of the map can be pieced together and each team can go and look for the treasures that are actually hidden in the natural area close to the garden. Each team will find a packet of seed with all the information on the current global extinction crisis and on the species of plant contained in the packet (Fig. 2).

Along the years the format of the treasure hunt has been maintained but has been differently characterized: in 1998 and 1999 two topics were proposed: edible plants and curative plants. Summer 2000 was dedicated to honeybees, honey and wax, linking the treasure hunt to the temporary exhibition “flying with the bees” held at the garden. A particular final session was added, introducing visitors to the art of candle making with natural bee wax. From Summer 2001 onwards the range of subjects was expanded introducing new sessions dedicated to many different topics such as preparing scented pouches with plant material, producing models of flowers made with paper or cotton fabric, creating decorations for windows with a botanical theme, cotton shopping bags, cotton shoes cases and ceramic pots decorated with botanical illustrations. All these objects are in some way linked with or derived from plants growing in the Garden.

‘Playing to play’

This particular game was added in summer 2004. Essentially different teams play sequentially in couples 3 different games (a memory using especially prepared tree cards, a botanical crosswords and a plant based mastermind) in order to get the necessary materials to design and prepare a further additional game (a plant based domino) that they can bring back home to play at their own ease. The stress is on having fun and being relaxed, but all 4 of these proposed games were re-designed and re-formatted in order to include plants and plant related issues in the game cards and in the tasks, activities and questions that participants are required to carry out as part of the game. Essentially in games that require matching symbols or numbers these are replaced by plants; in games that ask questions or riddles the topic is changed from its original, whatever this is, into plants, their uses and the importance of their conservation. Where possible participants are stimulated to find out for themselves answers and solutions on the basis of the material provided with the game rather than recall things they have been told or they should already know.

‘Do not get angry with plants’

This is another popular game that has been re-formatted with plant based cards and proposed to visitors from summer 2004 onwards. The classic game board has been re-designed alternating 4 different colours spirally leading to the central final square. The participants still play tossing dices and for each square they reach, they have a list of botanical tasks to perform each of them colour coded in order to match with the specific square they occupied. The botanical activities required by the game include: collecting a specific part of plants present in the garden (i.e. cones, lichens, leaves of particular shapes), looking for a particular type of plant present in the garden (i.e. medicinal plants, poisonous plants, endangered species) reporting its data, draw and paint some given plant or part of plant, find the use of a given species present in the garden, look for edible plants. When they finally reach the end of the game each group gets the opportunity to design and prepare a souvenir to bring back home such as a scented pouch with plant material, a flower made with paper or cotton fabric, decorations for windows with a botanical theme, cotton shopping bags, cotton shoes cases and ceramic pots decorated with botanical illustrations. All these objects are in some way linked with or derived from plants growing in the Garden.

Conclusions

Over 8 years, different games with different contents have been offered to visitors of Trento Natural History Museum Botanic Gardens. While formats and contents changed over the years the aim remained constant: to raise awareness of alpine plants and plants more in general, how they are present in each part of our daily life, and how we depend on them for our survival. It is hoped that these activities will contribute to make new generations aware of the importance of plant conservation for the sustainable development of our society and plant in them a sense of stewardship and care for our natural resources and plants in particular.

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Captions

Fig. 1 - A step of the botanical treasure hunt in Viotte Alpine Botanical Garden requires participants to distinguish the tasty true blueberry (*Vaccinium myrtillus*) from the tasteless bog blueberry (*Vaccinium uliginosum*) filling in a guide sheet and painting a drawing. These two confused.

Fig. 2 - Interactive steps introduce the plants grown in the Garden, and finally lead to the discovery of an envelope of seeds, the real treasure of the Botanic Garden.

4th STEP

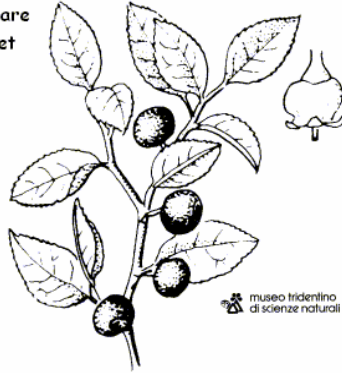
POISONOUS PLANTS

Pay attention to blue berries: they are tricky!

Go to point A and look closely at plant 1 **true blueberry** (*Vaccinium myrtillus* L.) and tick the right answer

- Leaves are: light green blue green
 the margin is dentate entire
 the stem is brown green like the leaves
 inside the berries are white violet

Look at the picture and paint it according to the answers you gave above



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Now look closely at plant 2 **false blueberry** (*Vaccinium uliginosum* L.) and tick the right answer

- Leaves are: light green blue green
 the margin is dentate entire
 the stem is brown green like the leaves
 inside the berries are white violet

Look at the picture and paint it according to the answers you gave above



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NOTE: even if is not poisonous the false blue berry should be avoided because it is tasteless and tricky.

Now move to point B and try to distinguish the true from the false blueberry. Write the answer on the main sheet.

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alpine botanical garden viotte - monte bondone

!!hurray!!

here is the treasure!!

Here are the seeds of the **FLOWER OF JUPITER SPECIES** (*Lychnis flos-jovis* (L.) Desr.) botanical family: CARYOPHYLLACEAE origin: Alps

The leaves and the stems of this perennial herb are covered by dense and velvety hairs that give them a greyish colour. Its flowers are deep pinkish red and appear in June and July. The flower of Jupiter only grows in the Alps (it is an endemic plant) and is listed in **Trentino RED DATA BOOK**. This means that this flower is running the risk of becoming extinct.

GROWING INSTRUCTIONS: sow in autumn or in spring and water regularly. Place in a sunny and rocky position. May be grown in pots.

To open cut along the dotted line

To open cut along the dotted line

Developing relationships with highly degraded ecosystems

Paul Blanchflower

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Abstract

The Tropical Dry Evergreen Forest (TDEF) of South India is now extremely threatened in its natural range due to high levels of human interference. Less than 1% of the natural forest remains and most of this is highly degraded. Consequently the local population in general, and the younger generations in particular have no real idea about the forest in its pristine state. The educational programs at the gardens aim to help the children to develop a relationship with this forest system through using children's stories based on the forest, showing them the plants, and involving them in activities at the gardens such as planting and raising of seedlings.

The underlying philosophy behind this approach is that when a relationship is formed through experience between an individual and another entity then there is concern from the individual towards the well being of the entity. Without the relationship there is no concern, and without concern there is no conservation effort. It is particularly hard to develop this relationship when the entity, in this case the Forest, is highly degraded, and thus uninviting, inhospitable and generally devoid of immediate interest. This is why it is important to give the children's imagination a helping hand through stories and fantasy.

Environmental responsibility is high in the awareness of many young people in India, and yet it is still an abstract concept brought in from the media and abroad. Thus as well as developing relationships it is important to show clearly to the children how in their daily lives they are being environmental responsible, and from this positive experience to indicate ways in which they develop this contribution to sustainability.

Introduction

The Auroville Botanical Gardens were established in 2000 on a newly acquired piece of land with the express purpose of helping to protect the biodiversity of the region, in particularly the Tropical Dry Evergreen Forest (TDEF), which is the local indigenous forest type. The TDEF of South India is now extremely threatened in its natural range due to high levels of human interference.

The forest is scattered in small temple groves of a few acres or in Reserved forest areas that were clear cut in the preceding centuries and as a result are a mix of thorny and pioneer species that bear little resemblance to the original forest cover. Less than 1% of the natural forest remains and consequently the local population in general, and the younger generations in particular have no real idea about the forest in its pristine state.

Work that has been on going in the International Township of Auroville over the past thirty years has identified over 400 woody species that are associated with this forest another 600 herbaceous species, of which over 450 have a recorded use either in medicinal or cultural practices.

Education programs

The educational programs based at the gardens and within other bio-resource centres within the township aim to help the children develop a relationship with this forest system through using children's stories based on the forest, introducing them to the plant and animal species of the forest, and involving them in activities at the gardens such as planting and raising of seedlings. They also discover how the plants are involved in their daily lives as medicines and useful materials. Care is always taken to give the children a chance to share their own knowledge about the plants, before teaching them something that they already know. It is a process of building upon the knowledge that they already have.

Programs are also run within local schools that introduce the children to both the plant and animal species from the forest through direct contact. Schemes have been introduced that link the children's activities with plants and assistance for their school fees such as planting trees within their villages and homesteads.

Creating relationships

The underlying philosophy behind this approach is that when a relationship is formed through experience between an individual and another entity then there is concern from the individual towards the well being of the entity. Without the relationship there is no concern, and without concern there is no conservation effort. It is particularly hard to develop this relationship when the entity, in this case the Forest, is highly degraded, and thus uninviting, inhospitable and generally devoid of immediate interest. This is why it is important to give the children's imagination a helping hand through stories and fantasy.

The gardens provide the children with a chance to experience the Forest species in a healthy state, an emerging ecosystem that provides an example of how the land can heal when given the opportunity.

Activities with the children

It has been found that the children enjoy working in the gardens and feel particularly proud of their contribution. Once the children feel an ownership to the gardens they are more interested to take part in programs that explore the natural world. Once again it is the creation of a relationship, this time one between the gardens and the child.

Type of Activity	Examples
Work	Nursery work, planting hedges, digging holes for trees, collecting seeds, moving soil and compost, burning dead branches, pruning hedges.
Play	Animal safari in the labyrinth. Games from "Sharing in Nature" program
Study	Collecting flowers and leaves, bird watching, building up species profiles and interconnections.
Creation	Drawing pictures, making up songs and dances about the plants
Exploration	Finding remnant vegetation in their own environment, creating resource maps of their schools and local villages.

Environmental responsibility is high in the awareness of many young people in India, and yet it is still an abstract concept brought in from the media and abroad. Thus as well as developing relationships it is important to show clearly to the children how in their daily lives they are being environmental responsible, and from this positive experience to indicate ways in which they develop this contribution to sustainability. In the first encounter the children are shown how much they already know about the names of plant and animal. The intention is to reveal to the children that they already have the beginnings of a knowledge base and then work in the programs is to show them why and how this knowledge is valuable and give them a chance to expand it.

Future developments

The education programs at the gardens are in their initial stages, working with a few of the local schools. However it is intended in the future to expand the programs to all of the schools within a 30km radius of the gardens. To this end we are currently building a new Education Resource and Research Centre that has been funded through a government grant. It is hoped that work on the building will be completed by August 2007. At the same time funds are being sort to purchase a bus that will bring the children to the gardens for the day and support the staff to run programs with the children.

It also intended to begin night camps with the more interested children from the schools in the immediate vicinity. The idea is to take the children through the gardens and adjacent forest areas to expose them to the nocturnal activities of the animals and the plants.

Biography

Paul Blanchflower graduated from Edinburgh University in 1991 with a degree in Ecological science. He moved to India in the following year and has remained there ever since involved in the restoration of the Tropical Dry Evergreen Forest. He is director of the newly established Auroville Botanical Gardens.

From standard educational programs to different interdisciplinary methods: Endangered vegetation in the Oslo region

Kristina Bjurreke

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In 2000, a new area was developed in the Oslo Botanical Garden (a part of the Natural History Museum). At the 'Oslo Ridge', we present plant species typical of the calcareous islands and hillsides of the inner Oslo fjord. Some of these plants have their northernmost distribution here. As a result of urbanization and overgrowth, several of them are now endangered in nature, and the Oslo Ridge functions like an ex situ conservation area. The other important aspect is its educational value in the ongoing teaching of school classes, teachers and the general public.

After some years of conducting standard educational programs at the Oslo Ridge, we felt a need to expand these teaching programs. The nearest island in the Oslo fjord (Hovedøya) is a typical example of the characteristic habitat of our local flora, and bringing classes to the island greatly enhances the quality of teaching. The island is easily reached by a public boat from the centre of Oslo. The contents of all the courses developed around the Oslo Ridge and the nearby island concern the themes of biodiversity and conservation.

Coincidentally, the island is now in the process of being declared a conservation area, and in cooperation with various cultural agencies, the Oslo Botanical Garden and Natural History Museum has been engaged in creating the necessary management plans. The biodiversity on Hovedøya is very high, as a result of the calcareous ground and the climate, but also as a result of many hundreds years of grassland management. Since meadows and pastures are a product of past and present land use, changes in land use always lead to changes in the plant cover. Grassland management on the island ceased some 80 years ago, and the meadows start to be heavily overgrown.

In the work with the management plans, we studied the old herbaria specimens from the island. Several plant species have already disappeared from the island as a result of the succession process when grassland management ceases. Therefore the plans for this island have been to evaluate the state of grassland management, the ecological conditions and the history of cultivation. We have evaluated the possibilities for resumption of grassland management and as a result the last three years selected areas are grazed and mowed.

As a serendipitous result, an interdisciplinary teaching program has evolved, in which the biology, ecology and cultural heritage of the Oslo region is taught in one exciting and comprehensive program. One of the topics is to inform how the biodiversity will change if grassland management ceases. In our educational programs we now have an arena where we can explain and demonstrate plant species well adapted to meadow management (haymaking and subsequent grazing) and species considered more favoured by grazing. As huge areas on the island are left untouched we also have the opportunity to demonstrate areas in early, intermediate and late phases of succession.

Botanical gardens have a national responsibility in protecting and preserving endemic species and species on the Red Data List. The programs connected to the Oslo Ridge in the Botanical Garden and on the Oslo fjord island give us a unique opportunity to communicate the important, global concerns of diversity and conservation in an intimately familiar and local setting.

In order to reach an even wider audience, an interactive web-site (www.hovedøya.no) was created in 2005 together with the Norwegian Institute for Cultural Heritage Research.

Now in 2006, we are producing a TV-film from the island. The purpose of the film is to highlight the unique biodiversity at the island and the connection between nature and culture. The themes will be 900 hundred years of different human activities, geology, botany, biodiversity, threatened species and what happens if grassland management ceases.

Through an upgrading course for teachers in Oslo in august-2006, we hope to get these important messages out to school children in our region. On the island Hovedøya we will present how the teachers can perform their own excursions, what they can demonstrate at different seasons of the year and thereby hopefully enlarge the awareness of diversity.

Plans for the future:

- We will evaluate how appropriate management has been on Hovedøya. Our goal is to work for a sustainable management on the unfertilized ancient grasslands on the island providing the biodiversity.
- We will continue to invite school classes and the public to guided tour on the island. One of the main topics will be importance of plant diversity and how it is interrelated to the history of cultivation and grassland management.
- Parts of the film and additional filming will be presented on interactive web-site.
- We have just started to make check lists of which regional, national and international threatened plant species already growing in the Botanical garden. The Norwegian Red List is under revision, and we must provide goals for which plant species our Botanical Garden will try to take responsibility to conserve.
- Seeds from endangered plant species in the SE part of Norway will be collected and our ex situ conservation project in the Botanical Garden will in two-three years cover threatened plant species from a larger part of Norway.



Trifolium montanum, status rare in the Norwegian Red List, grows only one place in Norway: at the island Hovedøya. By seed formation we have the species in ex situ conservation at the 'Oslo Ridge' in Oslo Botanical garden.



Dracocephalum ruyschiana, one of the plants threatened by ceased grassland management (listed in the Bern Convention). The species is growing on calcareous ground on the island Hovedøya and on the 'Oslo Ridge' in the Oslo Botanical garden.

The Inquiry, Integration and Differentiation Project: Professional development for middle-level Appalachian teachers at the University of Tennessee Gardens

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Abstract

The Inquiry, Integration, and Differentiation Professional Development Institute for Appalachian Educators (IID) was held at the University of Tennessee in 2005 and supported by an Improving Teacher Quality grant from the Tennessee Higher Education Commission. The aim was to build capacity through teacher professional development. The project addressed teachers' knowledge of content specified in the state curriculum framework by focusing on environmental science in a summer program followed by two academic year symposia, and also addressed pedagogical skills through training in inquiry strategies, subject integration, and differentiated instruction. The university gardens and a nearby national park were used for field studies. An independent evaluation concluded that the IID project substantially met its goals and objectives.

Description of the Project

The Inquiry, Integration and Differentiation (IID) project was conducted in 2005 at the University of Tennessee (UT) as a professional development opportunity for middle-level teachers in the state's Appalachian region. The median household income in this area is almost half the average for the United States, \$24,000, compared to \$41,994 for the U.S. as a whole, with over 20 percent of residents living below the poverty level (U.S. Census Bureau 2004). The unemployment rate in this area is nearly twice the state average (Tennessee Department of Labor and Workforce Development 2004). The percentage of students receiving free or reduced price lunches indicates the level of poverty of the school clientele. *All* (100 percent) of the children in two Cocke County schools receive free/reduced lunches. The school with the least has 64 percent on free lunches. In Scott County, the percentage receiving free or reduced lunches ranges from 80 to 92 percent. The schools in the Appalachian counties also serve many special education students, with percentages ranging from a low of 7 percent to several schools at 21-22 percent, one at 24.5 percent, and another at 34 percent. Researchers claim that differentiated instruction (Tomlinson 2003) is an effective way to address the high numbers of special education students in these schools.

Nadel & Sagawa (2002) argue that child poverty in the U.S. is greater in rural than in urban areas as poor rural children often receive substandard educations, inadequate health care, and have limited opportunities for further intellectual development. As for their teachers, researchers have noted that in the area of science many U.S. middle level teachers lack confidence in both their understanding of the content and their ability to "do" science (Lederman 1992).

The IID program was conducted at UT's botanic gardens, greenhouses, and laboratories as well as at field sites in the Great Smoky Mountain National Park. In the two-week summer institute and two autumn-term follow-up symposia participants received sixty hours of instruction provided by a multidisciplinary team of a science teacher educator, a botanic garden

educator/horticulturalist, two graduate students studying public horticulture, and several guest speakers. Guest speakers included a university instructor with expertise in evolutionary theory, the Acting Director of Georgia's Calloway Gardens, a visiting international scholar with expertise in environmental science, an environmental educator from the Great Smokey Mountains National Park (GSMNP), a biologist with the Park's All Taxa Biodiversity Inventory (ATBI) project, and an educator representing the "newspapers-in-education" program of the *Knoxville News Sentinel*.



Photo 1: Ranger leads participants in investigations in the GSMNP.

IID project aims were to advance participants' knowledge of plants and environmental science as well as to develop their educational theorizing and pedagogical skills, especially in using active learning strategies, inquiry, differentiated instruction (also known as "layered curriculum") and in developing outdoor study sites on school grounds. Participating teachers experienced an inquiry approach themselves as instructors modeled the recommended high-impact strategies. A communication network and Website (<http://web.utk.edu/~appalsci>) were created to provide resources to both participants and other Appalachian educators.

The IID project focused on curriculum and instruction in grades 4-8 (ages 9-14). Teachers at this level are at a disadvantage if they have not earned a degree in a content-area discipline or have not developed their expertise. Researchers have found that inquiry science is not taught in many classrooms due to teacher inadequacies in background and experience at this level (Brown & Bentley 2004). Many at this level recognize that they need more content background preparation, and also training in strategies to enact curriculum that better reflects the nature of the discipline.

In the U.S. in the past decade, professional development has responded to major policy changes at the federal level with the implementation of the No Child Left Behind Act. The introduction of curriculum standards for schools has emphasized rigorous teaching of content. Accountability for student achievement as measured by annual standardized multiple-choice tests has put new pressures on teachers. Across Tennessee as in others states, both science and social studies have

lost ground in the daily curriculum due to the emphasis on reading and mathematics. However, beginning in 2007, student achievement in science will be tested annually. One problem in the area of science is that many teachers lack confidence in both their understanding of content and their ability to “do” inquiry teaching (Lederman 1992).

Of course, reading and maths goals can be achieved through studying social studies and science, and in particular, environmental science. For IID project activities, environmental science using an inquiry approach was the focus. *Inquiry* teaching is recommended by both state and national standards documents, in science, the *National Science Education Standards* (National Research Council 1996) and Project 2061 (American Association for the Advancement of Science 1993); in math – the *Principles and standards for school mathematics* of the National Council of Teachers of Mathematics (NCTM 2000), and in two social studies documents, the *Curriculum standards for social studies* of the National Council for the Social Studies (NCSS 1994) and *Geography for life: National geography standards* (Geography Education Standards Project 1994). These various standards address conceptual understanding and include new curriculum content, such as, in science, the nature of science. Much of the new content in science and social studies is associated with a science-technology-society (S-T-S) approach, which naturally lends itself to multi-subject curriculum integration (Penick 2002).



Photo 2: Participants investigate bark flora and fauna.

In addition to the need for the content background, these teachers need to update their pedagogy. They need to know methods that are supported by research, including active learning strategies (Harmin & Toth 2006), problem-based and cooperative learning strategies (Thayer-Bacon & Bacon 1997), using technology appropriately (Penick 2002), and differentiating instruction

(Tomlinson 2003). Thus the IID program aimed to help participants develop both standards-based content background and an expanded repertoire of effective teaching strategies (Bentley & Alouf 2003).

The project also aimed to improve communication between different communities of the educational enterprise. Being geographically isolated, Appalachian educators can benefit from a professional support network as they take risks in teaching new content and trying new activities and strategies. An ideal network would include fellow teachers and content specialists, educators working in informal settings such as museums and parks, science teacher educators, and research scientists at universities and in industries. Such a network can provide on-going support via email and help in accessing the many resources of the Internet.



Photo 3: Teachers gather stems for rooting in the UT Gardens.

The IID project fostered the idea of teacher as *reflective practitioner*. A reflective practitioner has a base of knowledge that is built upon through on-going inquiry into the subject matter and through continually rethinking and reevaluating classroom practice. In this view, teacher development aims at renewal through *culture building* (Lieberman & Miller 1990). Recognizing that teachers are professionals with special expertise, we aimed at providing learning situations that would build on teachers' knowledge and experience. According to Ayers (1991), professional development is most effective when it unites what teachers are doing in their classrooms with reflection and inquiry, teacher voice, and valuing and analysis of personal and professional experience. When links are made between teachers and the resources that are "out there" many opportunities emerge for shared conversation and growth in content understanding and pedagogy. Reflective teachers know that good teaching is not a place where one finally arrives, rather it is always in process, evolving and changing in response to new situations. Teachers need a sense of professional community if they are to develop their skills and maintain enthusiasm and energy. Isolation, particularly characteristic of Appalachia itself, can result in either lack of self-

confidence or an idiosyncratic mode of operation. Teachers have much to contribute to the conversation and they have *the* key role to play in school improvement.



Photo 4: Teachers use vermiculite to root plant stems.

In summary, the IID project addressed: (1) content specified in state and national standards documents; (2) inquiry-oriented curriculum; (3) research-based teaching strategies and technology, and (4) a professional network to enhance peer communication and teacher access to the resources of the community.

Evaluation Results

An external evaluation team was contracted to provide formative assessment during the project, and a summative evaluation after the project concluded in late 2005. The evaluators used the following sources of data:

1. Interviews with participants,
2. Pre-post intervention surveys and content assessments,
3. Interviews of the project's principal director,
4. Review of project-related instructional materials and participant products.

The evaluators drew these conclusions based on the available evidence:

1. The design and implementation of the process for recruiting participants was thorough and effective in generating interest and applications. The recruitment materials were well designed and user-friendly.
2. Project staff made progress towards achieving all stated project objectives. Objectives that were not addressed to full potential related to the limitation in opportunities for collaboration due to a relatively low number of participants (8 instead of the targeted 25) and to low attendance at the autumn sessions.
3. Participants rated their project experiences extremely favorable.
4. Participants reported gaining new content knowledge consistent with project objectives and with the state curriculum framework.
5. Participants developed an understanding of new pedagogies introduced by the project, such as, inquiry-based and hands-on strategies, which they perceived to be readily transferable to their classrooms.
6. Participants reported that they had a limited opportunity to incorporate new knowledge in their classrooms thus far because the particular topics would not be addressed until later in the school year.
7. While less than a semester elapsed before participants were interviewed, they reported some opportunities to transfer the knowledge and skills they learned in the project. Teachers indicated that they had experienced some evidence of early effects on their students and some reported that their students were enjoying science more due to the hands-on, inquiry-based classroom activities they were employing as a result of the project.
8. Several unexpected benefits occurred: teachers reported that they transferred inquiry-based teaching strategies to other subjects. One elected to pursue teaching in Africa based upon project experiences with an African guest lecturer.
9. The inherent collaborations necessary for this project to be successful worked well. Project faculty and staff supporting the project, teachers, and school system officials worked together to ensure that participants experienced a meaningful and beneficial learning opportunity (Skolits & Graybeal 2006, 3-4).



Photo 5: Seeds sprouting in latex glove.

Recommendations

Based upon the data collected and analyzed for the IID project, the evaluators offered several recommendations:

1. In future projects, a verification and contingency plan should be in place so that each stage of the recruitment, selection, and applicant notification process occurs on a timely basis.
2. The wording of project objectives should be tightened. The objectives addressed significant purposes and the implementation of the project was consistent with stated objectives, however, objectives could be stated more concretely and expressed in terms that enable measuring the extent to which they are achieved.
3. Early collaboration and communication efforts with schools and teachers should take place, especially regarding any competing activities that may limit the number of potential participants.
4. Participants identified strengths of the project. Very few improvements for the future were recommended, however, scheduling follow-up sessions on Saturdays seems most worthy of consideration (Skolits & Graybeal 2006, 4).

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How to remain in the public eye

Bavcon Jože & Alenka Marinček

University Botanic Gardens Ljubljana, Slovenia

Abstract

The Botanical Garden of the University in Ljubljana had long been hardly present at all in the public life of the country. Our program has been divided into several levels: activation of journalists, organization of different events, guided tours for schools and groups of plant lovers, monthly lectures, workshops and writing articles to several magazines. The Garden also began to be promoted indirectly.

We are investing much effort in attracting attention of different media to get access to the public in the broadest possible sense (television, radio, newspapers) wherewith we have had considerable success in the recent years. Our presence in the media has progressed to a practically weekly basis. The indirect promotion of the Garden is associated to the fact that a number of television stations and various newspapers use it as a background for their contributions, shooting parts of their broadcasts in the loveliest parts of the Garden premises.

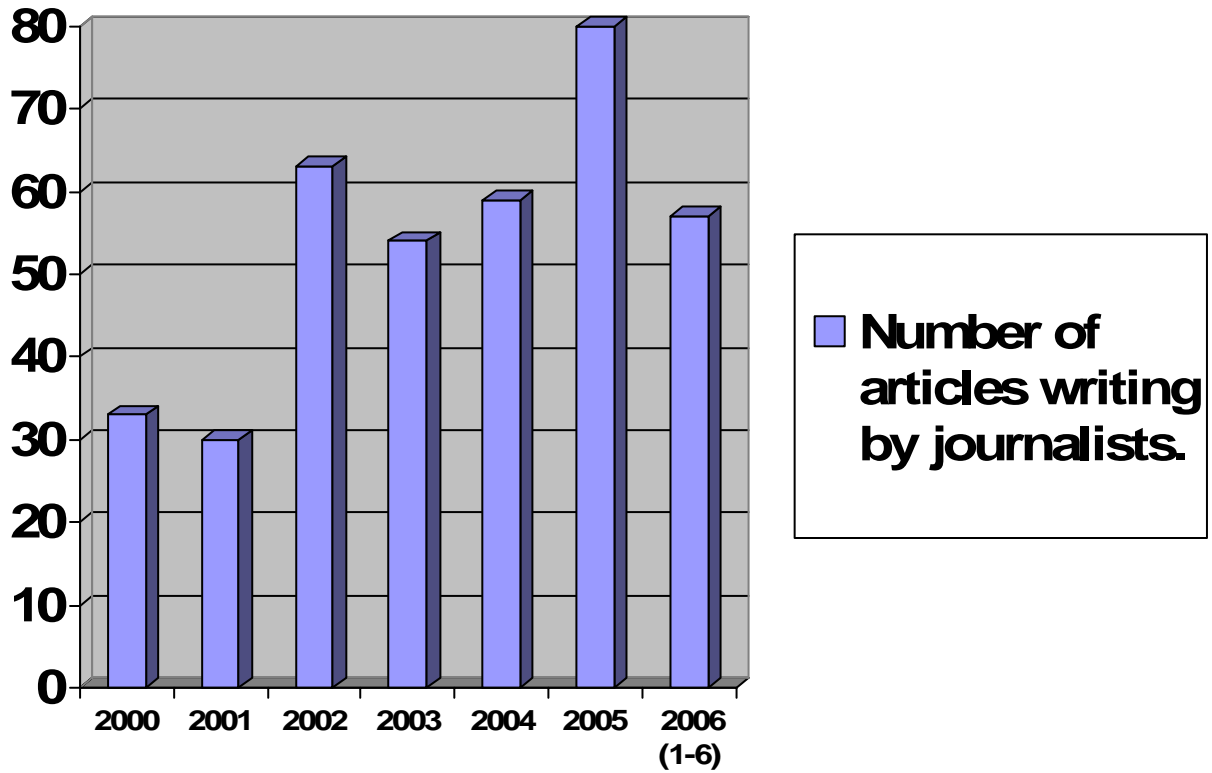
The goal of our endeavours is not only to present our Garden as such but also the activities and importance of botanical gardens in general, to enhance the interest of the broadest public in plant life and make it more aware of the need to protect plants and their habitats.

Introduction

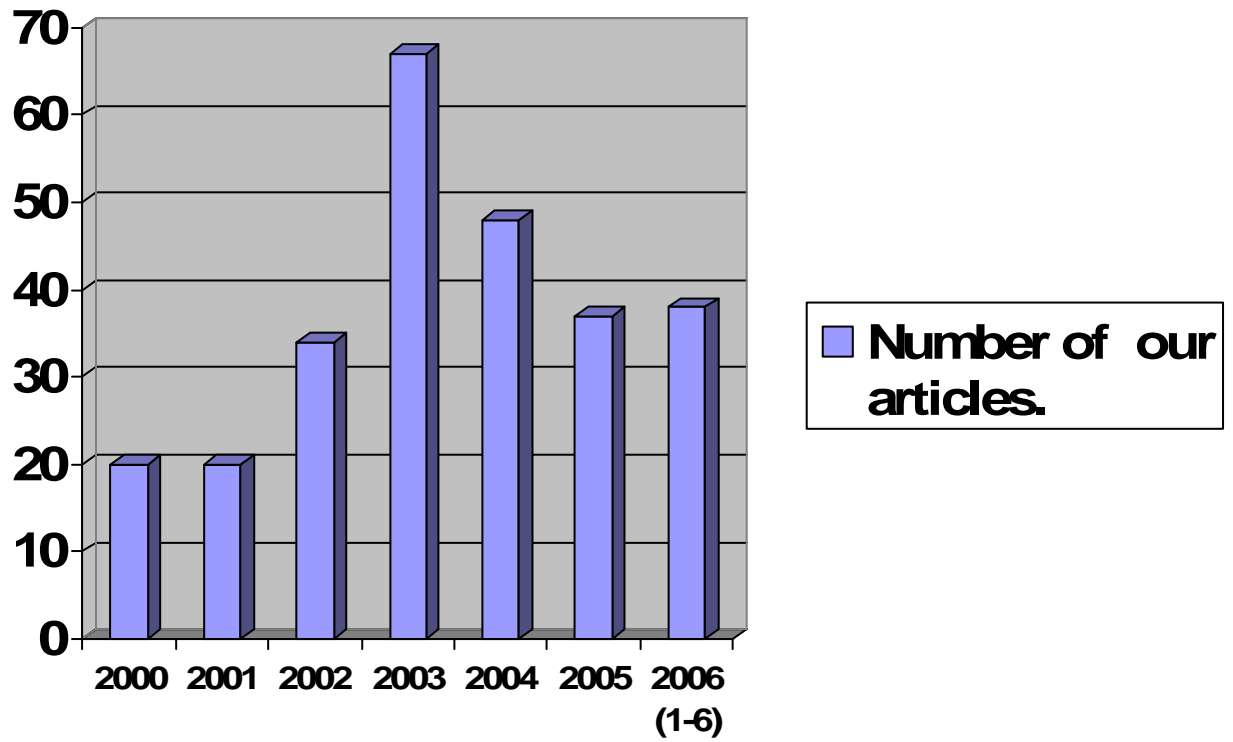
The Botanical Garden of the University in Ljubljana had long been hardly present at all in the public life of the country. In 1995 we embarked upon an intensive promotion campaign of the Garden in the public life. Our program has since 2001 been expanded and divided into several levels: activation of journalists, organization of different events. Added to the long-practiced guided tours for schools and groups of plant lovers, regular monthly lectures, workshops and announced guided tours. The representatives of the Garden began contributing monthly articles to several magazines. The Garden also began to be promoted indirectly.

We are investing much effort in attracting attention of different media to get access to the public in the broadest possible sense (television, radio, newspapers) wherewith we have had considerable success in the recent years.

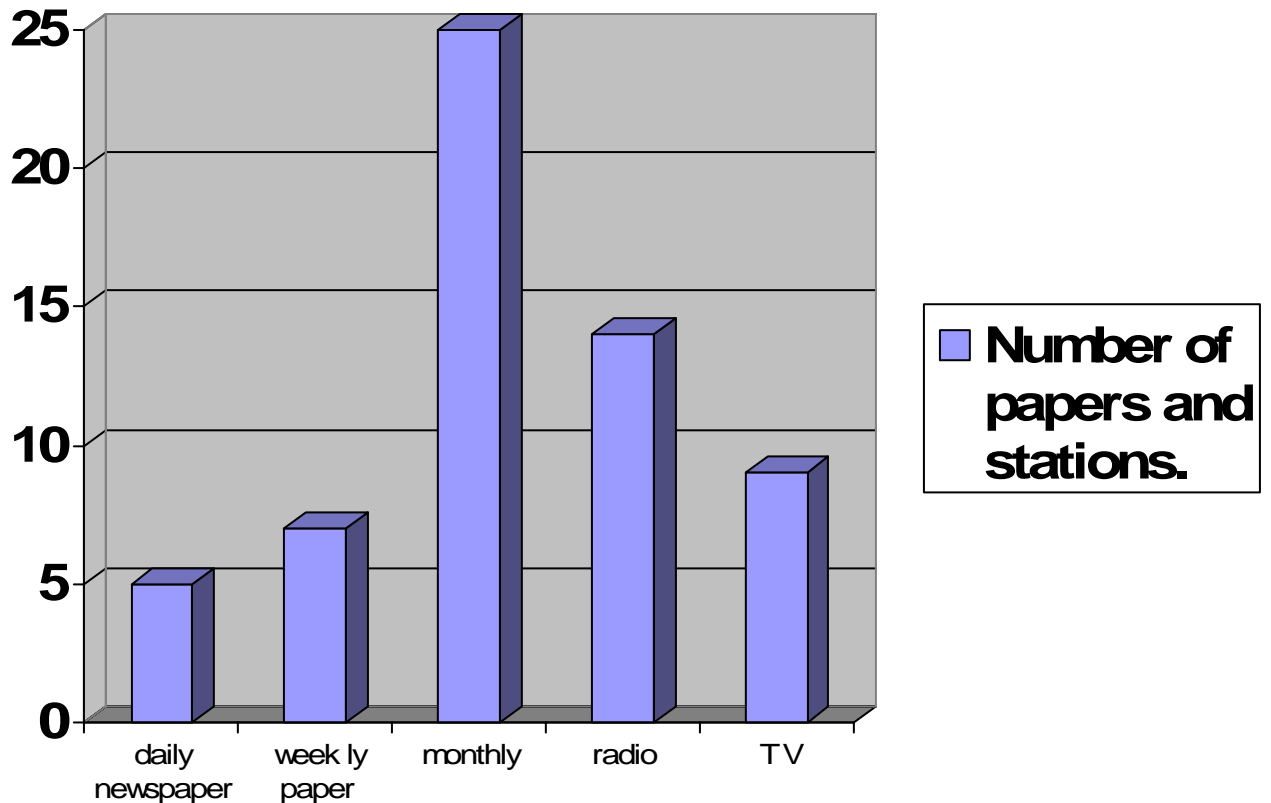
Results



Graph 1: Number of articles per single years, namely, by journalists reporting on the Botanical Garden or activities taking place on its premises. The 2006 data encompass but the first six months of the year.



Graph 2: Number of articles that the expert staff of the Botanical Garden contributed to different newspapers. The 2006 data encompass but the first six months of the year.



Graph 3: Number of various mass media in which the Botanical Garden featured in journalists' articles or our own contributions.

Discussion

In the last six years the Botanical Garden of the University of Ljubljana has affirmed its presence in the mass media. Shown in two graphs are Garden-related articles contributed by others and our own published articles dealing with various plant species, their cultivation and the importance of botanical gardens with their specific presentations. A third graph refers to different media in which we were present through journalists' articles or our own writing.

The Botanical Garden team is comprised of four full-time gardeners and one full-time expert, and one additional expert employed on a part-time basis. The Ljubljana Botanical Garden is visited each year by about 8500 primary and secondary school children and students for whom guided tours are provided by senior biology students properly trained for this kind of work. A considerable amount of time is being invested in the work with the media, as a result of which the public image of the Garden has acquired greater distinctiveness, thereby contributing also to that of other botanical gardens in Europe. However, in order to get media attention it is indispensable to engage in numerous additional activities and to constantly provide information on our work to the media. To this end the Botanical Garden organizes various workshops and lectures.

The Botanical Garden has featured in all daily newspapers, particularly the Delo, a daily with the largest circulation in Slovenia. We also managed to put our problems on the agenda of parliamentary questions. Articles on the Botanical Garden were published in all of the biggest local weeklies and monthlies. It was presented in several broadcasts on the national radio and TV, as well as some other stations. In the spring of 2006 three TV broadcasts, in three consecutive weeks, were dedicated to our work and in a broader sense to the importance of botanical gardens elsewhere, while problematizing the inadequate support of the State to this realm of activities in Slovenia.

The Garden found its way into the mass media also indirectly. It served as a scenic background or a promotional ambient to TV interviews, announcement of events by different TV stations, various promotional events in the printed media, as well as events organized on a variety of occasions such as presentation of books. These contributions often targeted an audience other than that interested in the issues of the previous paragraph.

Our articles on plants, their importance and the role of botanical gardens, occasional presentation of botanical gardens in the most widely read Slovenian daily Delo, regular publication of our Garden-related articles in three or four most popular gardening magazines (*Rože in vrt/Flowers and Garden*, *Gaia*, *Moj mali svet/My Little World*, *Vrtnar/Gardener*) - all of this has enhanced the public interest in our autochthonous plants and also in the mission of our garden.

Our activities of the last six years have brought increasingly positive results in terms of the number of visitors and their reaction to the Botanical Garden, and also with respect to a more distinctive public image and importance of this institution. This has been reflected in a livelier interest of the mass media in our activities.

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Playing with plants, learning for life

Ana Raquel Barata, Alexandra Escudeiro & Maria Amélia Martins-Loução

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Education for sustainability is now a main subject at international summits throughout the world as it is considered an essential way to guarantee sustainable life quality and Nature conservation.

The Botanic Gardens primal purposes for botany studies and maintenance of plant collections represent nowadays important objects to perform education for sustainability and biodiversity conservation. Educational activities at Botanic Gardens demonstrate how plants can be a learning tool to promote ecosystems conservation and achieve sustainability as its collections represent an important stock for biodiversity. This biological richness within urban centers allows children to experiment, see and touch different plants from all over the world and therefore better understand its threats and the need to promote its preservation to achieve sustainability (Avery 1971).

These collections promote education about plant diversity, plant relations with the environment, importance for the mankind and ecosystems, to teach about native plants, about threats for plant biodiversity and the need to preserve the environment locally and throughout the world (Willison 2003).

The Botanic Garden of Lisbon is located at the heart of the capital representing not only an important green area within the urban net but also historical, cultural and scientific knowledge about plants, its importance, ecology and current threats.

In 2004, the Education Office of the Lisbon Botanic Garden belonging to the National Museum of Natural History created a new concept: the school holiday courses. These courses aim to offer the possibility for children to occupy their free time within an important educational environment such as Botanic Gardens.

Assuming that only knowledge promotes behavioural changes to develop ecological attitudes (Scoullos & Malotidi 2004), these courses use children free time to play pleasingly and learn smoothly the basics of plant ecology and conservation, aiming to achieve the practice for sustainability. While playing with each other children are invited to experiment, create and learn about a chosen theme that concerns plant ecology, environment and biodiversity preservation in a beautiful and cultural background such as the Lisbon Botanical Garden (Figure 1).

In order to motivate children to repeat the courses, week themes are always different within plant ecology and conservation subjects (eg. Flowering and Pollination; Plants and Animals: living together; Caring for Nature: Caring for Life; Native Plants Preservation).

Activities programmed on a theme allow children to learn about plants and become familiar with the Botanic Garden in a weekly program occupying elementary school students' free time, working on sustainability concepts, reusing and recycling materials through games, art work and theatre plays.



Figure 1

Courses are composed by two different class ages, each one with 15 children (4-6 and 7-13 years). The weekly themes are similar to both groups but activities and their evaluation are adapted to children's age. Courses are programmed concerning specific objectives and activities for each day assuming that the assembly of results establish the week context and general objectives within the theme. During the course children are also taught how to recycle garbage. Each day starts at 9h00 a.m. with games about plants which allow children not only to learn about the course theme but also to get acquainted and to know the Garden; at 10h00 a.m. weekday activities take place; at 17h00 p.m. activities end and parents arrive.

Guidelines about plants and environment preservation within the world and the Garden are presented just on Monday morning. Afterwards children are taken for a complete tour through the Botanic Garden regarding the weekly theme and asked to collect plant materials to use at the afternoon art workshop. Children are warned to collect fallen plant parts only, in order to keep Garden's biodiversity. Art workshops aim to exhibit children's creations about the theme within the classroom which are to be used as props for last course day play presentation. On Tuesday the activities aim at raising nature conservation awareness. Therefore, children learn about compost making, paper recycling to use in herbariums as well as to reuse materials in art work. On Wednesday and Thursday children are invited to work in groups creating a story about the weekly theme and reusing materials to construct props and scenario sets. On Friday children carry out experiments using plant materials and the microscope to observe different structures concerning the weekly theme (eg. thorns in Mediterranean plants). Each course ends with an evening play presentation to parents, family and friends about the theme discussed during the week (eg. Native Plants Preservation).

Children may repeat courses as themes are different though interconnected but always targeting to raise conscience about plant ecology, current environmental threats and sustainability.

The use of free time in different learning activities such as painting, modelling, playing pedagogical games or presenting plays involving parents and family has shown very good results at the evaluation of the activity. Questionnaires are made to the older group before and after each course to evaluate acquired knowledge on the course theme, attitudinal changes based on

sustainability principles and satisfaction on doing the course. Parents also answer a part of the questionnaire to show their level of satisfaction and confirm changes on knowledge and/or attitudes within the children and family towards the course theme and objectives (Stokking et al. 1999).

As for the younger group, they are asked everyday to draw what they have done and learned about the week theme. Parents also answer before and after questionnaires with children help.

Questionnaires and drawings allow the evaluation of course activities, the impact of the week theme and the success of the course on promoting plant knowledge and awareness to guarantee an ecological behaviour that copes sustainability.

This work has shown relevant results in terms of taught concepts and attitudes concerning an active participation of more than 200 people, including children, their family and friends attending the Lisbon Botanic Garden's holiday courses in 2005. Moreover, the number of children that are willing to participate increases every year, as well as those wishing to repeat the experience. Courses evaluation results validates the programmed activities and methods towards their objectives and have shown that permanent family group awareness about the importance of plants, as well as ecosystems preservation, is a potential effective way to promote Nature conservation and sustainability within a social behaviour framework.

The positive impact demonstrated by the results of these activities indicates that it should be repeated as many times as possible. The idea was born in 2004 and since then it has grown heading for future development. Holiday courses at the Botanic Garden of Lisbon are now very important events within Lisbon community bringing more urban people to know the Garden and to adopt new ecological attitudes to achieve sustainability as they play with plants to learn for life.

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EXPLORING VISITORS' MOTIVES, EXPECTATIONS AND EXPERIENCES IN BRISBANE BOTANIC GARDENS

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Visiting botanic gardens is a popular cultural activity in Australia (third after “cinema-going” and “visiting libraries”), with approximately 6 million people (42% of Australia’s adult population) visiting a botanic garden in 2002 (Australian Bureau of Statistics, 2005). Contrary to popular perception, the highest visitation was for those aged 25-44 years, with over 65s being the least likely to visit of all age groups.

Gardens vary widely in their design, purpose and features visitors have a wide variety of motives for visiting. Motives identified in previous research include appreciation of the aesthetic and rare qualities of plants; interest in garden design and landscaping techniques used in different periods of history; admiration of gardens’ scenery and ‘ambience’; and pleasure in being outdoors (Connell and Meyer, 2004). The peace and tranquillity of garden spaces and their spiritual and restorative benefits have also been identified as features that attract people to public gardens (Bennett and Swasey, 1996; Council Heads of Australian Botanic Gardens, 2005; Darwin-Edwards, 2000). Other reasons for visiting gardens include recreation, playing games and/or social interaction (Bennett and Swasey, 1996; Darwin-Edwards, 2000); the desire to gain inspiration (Bennett and Swasey, 1996); and the opportunity to relax and/or read (Bennett and Swasey, 1996; Crilley and Price, 2005). Sociocultural factors such as the growing number of people participating in gardening as a leisure pursuit, the rising popularity of lifestyle/gardening television programs and increased coverage of environmental issues in modern media have also been linked to the popularity of garden visiting (Connell, 2004; 2005).

Throughout the world botanic gardens are starting to take a greater responsibility for educating the public about global environmental change and conservation issues (Mintz and Rode, 1999; Willison, 1997). Due to their informal and aesthetically pleasing surrounds, gardens have the potential to provide informal learning experiences that not only promote the importance of plants, habitats and conservation, but also influence the values, attitudes and actions of their visitors (Willison, 1997). Botanic gardens are particularly well placed to showcase the interrelationships between plants, animals and humans and to explain how the different components are inextricably linked and interdependent (Jones, 2000). This role is critical, as according to Minter (1997), many urban societies do not perceive obvious links between plants and everyday commodities such as food, clothing and medicines.

Well designed interpretation that communicates the importance of preserving plants for the future well-being of the planet is essential if botanic gardens are to achieve their conservation goals. Without such interpretation, gardens will face the possibility of becoming little more than attractive parks or urban spaces (Botanic Gardens Conservation International, n.d.). Indeed, the Council Heads of Australian Botanic Gardens (2005) claim that raising public awareness of the importance of biodiversity is critical in fostering conservation because it “...leads to an appreciation of the need to preserve natural habitats, to an understanding of the threats and consequences of loss of biodiversity, and to an appreciation of counteractive measures that can be taken” (page 2). Despite this, many Australian botanic gardens allocate less than 10% of their total budget to public education (Smith, 1997).

Interpretive programs in botanic gardens range from guided tours with specific themes to exhibits, displays and interpretive signage. Botanic gardens may also produce printed leaflets, guidebooks, maps and brochures that outline self-guided walks. Many gardens offer community programs and courses on topics such as propagation, weed control and plant adaptations (Foster, 1997), while others host annual displays and plant sales by local horticultural groups. Almost all botanic gardens display plant labels to inform visitors about the species on show.

Because garden visiting is usually voluntary and self-directed, learning occurring during these visits is generally classified as 'free-choice' learning. Many educators argue that people visit gardens for leisure and social interaction and that learning is not high on their agenda. For example, a recent survey in Adelaide Botanic gardens by Crilley and Price (2005) found that although 57% of respondents cited 'viewing plants' as one of the three main reasons for visiting, only 15% were motivated by the desire to 'learn about plants'. Indeed, it is generally accepted that the majority of visitors to botanic gardens do not come to learn per se (Darwin-Edwards, 2000). However, according to Butler and Serrell (2000) exit surveys show that visitors do in fact learn from garden visits and that this learning is both short and long term. They emphasise that informal learning is not just knowledge-based, and recommend that activities and messages be designed to 'tap into' cognitive domains (knowledge and the development of skills); affective domains (values, emotions, attitudes) and/or psychomotor domains (movement and motor skills). The authors argue that if well designed, these activities have the potential to impact upon visitors' knowledge, attitudes and future behaviour.

Despite the emphasis botanic gardens place on educating the public to support their conservation efforts, there is very little research examining the educational impacts of gardens on visitors. Studies have tended to regard visitors as "passive recipient[s] of the knowledge which the exhibition designers wish to transmit" (Tofield, Coll, Vyle and Bolstad, 2003, p. 71). As mentioned, management strategies tend to be based on the premise that providing information about plants educates visitors and this in turn will lead them to behave in an environmentally responsible manner. However, researchers argue that this view is too simplistic, and that to be effective, interpretive materials must be specifically tailored to meet the knowledge, interests and needs of target audiences (Orams, 1994). In other words, facts must be combined into meaningful messages that enable visitors to make connections between their previous experiences, their immediate surroundings and the issues being interpreted (Ballantyne, Crabtree, Ham, Hughes and Weiler, 2000).

Educational research shows that learning is highly idiosyncratic, and depends upon the interaction between learning environments (in this case gardens) and learners' pre-visit conceptions, attitudes, knowledge and behaviour (Ballantyne et al., 2000). The design and delivery of effective learning experiences therefore requires managers and interpreters to develop a clear idea of visitors' knowledge and interests, and to design experiences that match these. To date, there have been very few studies conducted in this area, however, a survey by Connell (2004) did find that approximately 70% of visitors to UK gardens describe themselves as having a general interest in gardens. Only 10% had a special horticultural interest, and the remaining 20% were using the garden as a venue for a pleasant day out.

It is apparent that although a very popular activity, botanic garden visitation is not well understood. There have been few systematic studies examining visitors' motives and how they relate to learning in garden settings. If gardens are to foster community understanding, engender pro-conservation attitudes and encourage visitors to become personally involved in conservation activities, we need to discover *why* people are visiting in the first place. What are their motives, expectations, prior knowledge and interests? Answers to these questions will provide an insight into how to design and deliver garden experiences that continue to attract and inspire visitors.

The research reported here aimed to investigate

- visitors' motivations for visiting Botanic Gardens, and to compare these with visitors to other free-choice learning settings such as museums, zoos/aquariums, heritage sites, natural areas and ecotourism activities;
- visitors' levels of environmental awareness and interests; and
- the impact of Botanic Gardens visitation on visitors' conservation learning.

METHOD

Research site

This research was conducted at Brisbane Botanic Gardens, Mt Coot-tha. The gardens were established in 1970 and feature a series of distinctly different areas arranged in themes such as 'Australian Plant Communities' and 'Fragrant Plant and Herbs'. There are educational programs for students from pre-school to Grade 12 and free one-hour guided walks for the public six days a week.

Procedure

Pre-visit and post-visit questionnaires were used to explore visitors' motives, interests and conservation learning. A researcher stationed at the main entrance approached visitors during a six week data collection period. (Days sampled included weekdays, weekends and school holiday periods.) The aims of the research were briefly outlined and participants were offered a chance to win one of two family passes to the Sir Thomas Brisbane Planetarium (sited within the Botanic gardens precinct). Those who agreed to participate were given folders containing a pen, a pre-visit questionnaire and a post-visit questionnaire. They were asked to complete the pre-visit questionnaire on entering the garden and the post-visit questionnaire immediately prior to exiting. The completed questionnaires and folders were collected as visitors exited the gardens.

Participants

A total of 150 visitors (54 males; 85 females; 11 unidentified) completed both pre- and post-visit components of the questionnaire. The majority of these (73%) were Brisbane residents, with 10% being from other parts of Queensland, 8% from interstate and 9% from overseas. These percentages reflect the visitor statistics collected by the Botanic Gardens.

Given the large proportion of local visitors, it was not surprising that 73% of participants were repeat visitors. It must be noted, however, that 16 Brisbane residents (15%) had never been to the gardens before (see Table 1). Approximately half of the 107 repeat visitors indicated that they had visited the gardens ten or more times.

Residence	Been before		Total
	No	Yes	
Local	16 (15%)	91 (85%)	107
SE Qld	2 (22%)	7 (78%)	9
Qld	5 (71%)	2 (29%)	7
Interstate	8 (73%)	3 (27%)	11
Overseas	9 (69%)	4 (31%)	13
Total	40	107	147

Table 1: Respondents' previous visits to the botanic garden by place of residence

Most participants had come to the Brisbane Botanic Gardens as part of a family group (61% of the sample) or as a couple (21%). Family groups generally included one or two children (48% and 29% respectively). Only three of the 150 participants had visited on their own.

As illustrated in Figure 1, the most common age group participating in the research was 30-39 year olds (32%), followed by 40-49 year olds (25%). Visitors over 60 years old represented only a small proportion (13%) of the sample, dispelling the commonly held perception that botanic gardens attract mainly older adults. These patterns are similar to national trends (Australian Bureau of Statistics, 2005) which indicate that highest visitation is in the 25-35 year bracket followed by 35-44 year olds. This may in part be due to the composition of visiting groups as most of those aged between 30 and 39 (74.5%) visited with children.

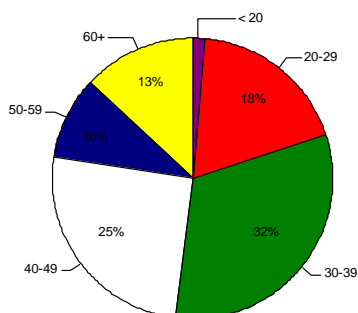


Figure 1: Age distribution of survey participants (only adult visitors were invited to participate)

RESULTS AND DISCUSSION

Visitor Motivation

Respondents were asked to rate, on a 7-point scale, the importance of 34 items as reasons for coming to the Gardens. Of the 35 items, 25 have been shown in previous research in free-choice learning environments to represent five categories of personal goals: Learning and Discovery; Passive Enjoyment; Restoration; Social Contact and Personal Self-Fulfillment (Packer, 2004). (The present data confirmed a Cronbach alpha > .79 for all five of these subscales.) An additional 9 items were included to address reasons specifically related to gardens, plants and nature. Factor analysis revealed two factors underlying responses to these items: learning about plants and gardens; and enjoying plants and gardens. Mean responses to the seven subscales are reported in Table 2, together with comparable data from seven other sites on the first five subscales (Packer, 2004).

	MU	AG	WC	AQ	HS	NA	EC	BG
Passive Enjoyment	4.28	4.33	4.80	4.41	4.60	4.23	4.37	4.42
Learning and Discovery	4.69	4.46	4.31	4.24	4.38	3.89	4.21	3.23
Restoration	3.08	3.29	3.94	3.86	3.85	4.10	3.74	3.94
Social Contact	1.99	2.04	3.03	2.73	3.44	3.12	2.37	2.47
Personal Self-Fulfillment	2.56	2.73	2.42	2.46	2.33	3.27		2.04
Learning about plants/gardens								2.51
Enjoying plants/gardens								4.74

Note. MU = museum; AG = art gallery; WC = wildlife centre; AQ = aquarium; HS = heritage site; NA = natural area; EC = ecotourism experience; BG = botanic gardens

Blank cells were not measured

Table 2 Personal Goal subscales by site

These data suggest that Botanic Gardens visitors are more similar to visitors to the natural site than any of the other sites, in that visitors placed greater importance on restoration than on learning and discovery ($t_{141} = 6.59, p < .001$). Frequent visitors (those who had visited at least 4 times before) were more likely to be motivated by restorative factors and enjoyment factors (both general enjoyment and specific enjoyment of plants/gardens) than first time or infrequent visitors. First time visitors were more likely to be motivated by learning and discovery.

Considering responses to the individual items rather than the subscale scores, the most important reasons given for visiting the Botanic Gardens were: to enjoy myself; to admire the garden's scenery; to spend quality time with family/friends; and to enjoy being outdoors/in nature. These motives are similar to those reported in previous garden research. For example, Connell and Meyer (2004) identified 'admiring the scenery' and 'enjoying being in the outdoors' as key motives for visiting gardens; while Bennett and Swasey's research (1996) highlighted the attraction of 'finding peace and tranquillity', 'relaxing mentally' and 'social interaction with friends and family'.

As in previous studies (e.g., Crilley and Price, 2005; Darwin-Edwards, 2000), visitors were not particularly motivated by the desire to learn about plants and/or gardening, and the importance of learning and discovery in general was lower than for most other free-choice learning sites. In this respect, they were more like natural areas, where visitors are more interested in the restorative aspects of the environment than in engaging in a learning experience. McLaughlin (1998) suggests that in natural areas it is the outdoor sensory experience itself that attracts visitors. Thus visitors may simply wish to absorb the atmosphere of their surroundings and have little interest in individual plants and ecosystems. This suggests that if botanic gardens are to introduce more educational activities and promote

conservation, they need to carefully consider how these are designed and promoted. Activities with a strong educational emphasis are unlikely to appeal to visitors. Rather, the focus may need to be on developing restorative and social experiences that convey the importance of environmental conservation.

Visitors' environmental awareness and interests

As conserving plant species and educating the public about environmental conservation are key activities of botanic gardens, this research was particularly interested in exploring the existing conservation interests, values and practices of people visiting botanic gardens. Conservation commitment and interest was measured by asking visitors to rate how closely a list of conservation attitudes and practices described them on a seven point scale ranging from 1 (doesn't describe me at all) to 7 (describes me perfectly). The items fell into three categories: environmental interest; environmental action; and interest in gardening. Respondents were classified as low (ratings of 1-2), moderate (ratings of 3-5) or high (ratings of 5-6). Responses were in the moderate range for environmental interest and interest in gardening, and in the low range for environmental action. Visitors to botanic gardens would thus appear to be not particularly concerned about environmental issues and unlikely to be actively involved in undertaking action for the environment. This is a challenge for those concerned with educating visitors about the importance of conservation and biodiversity.

Frequent visitors were more likely to enjoy gardening than first-time or infrequent visitors ($t_{142} = 3.16, p < .01$) and older visitors (over 40) were more likely to enjoy gardening than younger visitors ($t_{136} = 2.68, p < .01$).

The impact of Botanic Gardens visitation on visitors' conservation learning.

Visitors were asked to indicate the extent they agreed or disagreed with the statements "This visit has encouraged me to care more about conserving our natural environment" and "I have learnt about the relationship between humans, the environment and conservation from my visit". Most responses to both items were in the moderate range.

Visitors who reported higher environmental interest were more likely to report having learnt, or been encouraged to care more about the environment as a result of their visit. Similarly, those who were more environmentally active before the visit were more likely to report learning, and those who reported greater interest in gardening were more likely to report learning. People high in all categories of motivation were more likely to report learning.

To explore what visitors were learning as a result of their visit in more detail, researchers asked respondents to list the main things they had learnt about plants and/or gardening. Only half the sample answered this question, though it is unclear whether this was because they hadn't learnt anything or because they were reluctant to answer open-ended questions in an essentially 'tick and flick' style questionnaire. However, 15 of those who did answer stated they learnt nothing because they had not come to the gardens to learn in the first place. The main things respondents did learn were that a wide variety of plants grow in the Brisbane climate (mentioned by 12 people); the names of plants (11 respondents); how to use plants in their own garden (11 respondents); the age of Bonsai plants (7 respondents); the origin of particular plants (7 people) and a general appreciation of the many colours of nature (7 respondents). Interestingly, none of these relate to plant conservation issues per se and not one respondent mentioned the importance of preserving native species, promoting plant biodiversity or using sustainable gardening techniques, all key educational goals of botanical gardens. It would seem that there is considerable scope for introducing learning activities that

focus on the reason d’etre of botanical gardens; namely, preserving plant species and educating the public about the importance of conservation efforts.

Although initial responses suggests that visitors may not learn much from their visit, subsequent items show that they reported a substantial change in their knowledge, attitudes and intentions as a result of their visit. These changes were measured by asking respondents to indicate on a 7 point scale how they felt about 14 conservation-related statements before and after their visit. Responses ranged from 1 (do not agree at all) to 7 (agree completely). Statements are presented in Table 3 in decreasing order of change between pre and post visit. All were significant at the 0.000 level.

Statement	Mean before	Mean after	Diff
Visiting botanic gardens renews the human spirit	4.74	5.32	+.58
Being in nature helps me recover from the stress of everyday life	5.16	5.73	+.57
Visiting botanic gardens is relaxing	5.74	6.28	+.54
We need to help protect natural environments	5.51	5.95	+.44
I know some things I can do to protect nature	4.39	4.81	+.42
I want to do everything I can to protect and conserve nature	4.89	5.30	+.41
Nature helps define Australia’s national heritage and character	5.35	5.75	+.40
I am interested in finding out more about conservation	4.27	4.66	+.39
I am part of the solution to nature’s problems	4.49	4.86	+.37
There is a lot I can do to help	5.63	5.99	+.37
Plants are amazing	5.18	5.55	+.36
I understand the impact of my actions on the environment	5.02	5.33	+.31
We have the responsibility to leave healthy ecosystems for our families and future generations	5.82	6.13	+.31
I am part of nature’s problems	4.70	4.93	+.23

Table 3: Differences between visitors’ pre and post visit scores on conservation-related statements

It is interesting to note that the biggest changes between pre- and post-visit were on statements relating to the restorative benefits of gardens. For example, the top three statements were that visits to botanic gardens renew the human spirit, aid stress recovery and are relaxing. This suggests that future gardens promotion could broaden the garden’s appeal by emphasising the personal, restorative benefits of wandering through garden environments.

Table 4 reports the extent to which visitors reported that particular aspects of the garden enhanced their interest in environmental conservation.

Just seeing many different plants	3.39
Being able to walk through the gardens	3.67
Discovering why environmental conservation is important	3.15
Participating in a guided tour of the gardens	1.96
Being in beautiful surroundings	4.08
Reading labels and signs in the gardens	3.50
Feeling an emotional connection with nature	3.37

Table 4. Aspects that helped visitors become interested in conservation

Visitors' suggestions for improvement

Visitors were asked if they had any suggestions for improving information and/or learning activities at Brisbane Botanic Gardens. By far the most common suggestion was to introduce interactive activities for children (mentioned by 33% of those giving suggestions). Garden visitation is obviously a social activity that attracts a high proportion of families with children. The provision of hands-on learning experiences specifically catering for younger clientele would probably have a substantial impact on both children's and care-givers' enjoyment. It would also facilitate social interaction amongst family members, which is a key motive attracting visitors to botanic gardens. Five respondents also suggested that more plants be labelled, and a further three wanted interactive activities for all visitors.

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Exploring organisational learning and change for sustainability in a Kenyan context

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Introduction

Since the 1992 Rio Earth Summit, sustainability change has become increasingly important to organisations. Understood as complex social systems, organisations possess norms and values that may enhance or constrain sustainability change (Doppelt 2003). A focus on transforming norms and values through learning is therefore fundamental to education for sustainability initiatives in organisations. This paper shares findings from an ongoing critical action research study that is exploring organisational learning and change for sustainability within a Kenyan context.

The study examines aspects of organisational culture, power relations and team learning to explore organisational learning and change for sustainability at the National Museums of Kenya (NMK). Through a process of critique, the study has identified contextual issues that constrain sustainability change at the NMK. Basic assumptions underlying these contextual issues have been critically reviewed and surfaced through critical reflection. Through a focus on improving information flows at the NMK, the paper highlights how assumptions that do not align with sustainability principles are being altered to enable cultural change.

A central argument in this paper is that sustainability is an ongoing multi-dimensional learning process that seeks cultural change (Tilbury 2004) through communicative action in organisations. I promote a notion of ‘cultural change’ as an education strategy for enabling and achieving sustainability within organisations. A cultural perspective on organisational learning for sustainability is advanced.

Research design and process

This study is being undertaken at the National Museums of Kenya (NMK) where I work at the middle level management. NMK is a non-profit heritage conservation organisation that plays a significant role in the provision of environmental education programmes in Kenya. The study has three aims: to identify contextual issues related to sustainability change at the NMK; critically review and alter basic assumptions underlying these issues; and explore a critical action research epistemology on the ‘reality’ of sustainability change. The paper reports on preliminary findings from the first two aims.

The study follows a critical action methodology that entails a commitment to socially transformative research in which ideological and power-related issues are addressed in organisations (Guba 1990). The methodology is grounded in a vision of organisational change and democratic values (Fien & Hillcoat 1996). Three stages underpin the study. The first one involved identifying contextual issues that constrain and enhance sustainability change at the NMK. The second stage entailed acting upon some of the identified issues towards sustainability

change in collaboration with a research team. The final stage will entail institutionalising sustainability change at the organisation.

Empirical evidence is gathered at two levels using focus groups, workshops, journals and audio recording research techniques. At one level, I am implementing organisational learning and change processes with a team of fellow employees using *participatory research* method. At the second level, I am undertaking a *critical action research* process to review and alter basic assumptions related to sustainability change. Action research as used in this study describes processes of planning, transformation and evaluation that draw on insider practitioner inquiry and reflection (Armstrong & Moore 2004).

Theoretical framework

Habermas's (1984, 1987) social theory of *communicative action* forms the basis on which to understand organisational learning and change for sustainability at the NMK. I theorise the concept of 'organisation' simultaneously as both *system* and *life-world* (Habermas 1987). The life-world is a differentiated structure closely bound up with cultural values and communicative practices. It is characterised by implicit assumptions about norms and values. Transforming norms and values through learning is thus essential to education for sustainability change in organisations. It was through the life-world and its institutions that communication became possible as we sought sustainability change through reflective understanding and learning. I have acted on contextual issues that constrain sustainability change within a *systems thinking* perspective (Sterling 2004). My underlying argument is that organisations as both *cultures* and structures of *communicative action* can be transformed through environmental education to enable sustainability change.

This study draws from both fields of environmental education and organisational studies. Socially critical theory of environmental education (Fien 1993) has provided pedagogical assumptions underpinning sustainability change. Organisational learning and change theories (Senge 1990, Schein 2004) have provided strategies required to enable sustainability change within a systems thinking perspective.

Identifying contextual issues and envisioning new possibilities

Currently, the NMK is undergoing major legal, infrastructural and restructuring organisational changes termed as 'Museum in Change'. This study has drawn from these wider changes when exploring organisational learning and change for sustainability. At the same time, the study is contributing useful ideas towards the 'Museum in Change' initiative.

A starting point for seeking cultural change at the NMK was to identify contextual issues related to sustainability change through a process of critique with the research team. This required a critical social and political analysis of the NMK organisational structures and processes (Huckle 1993). I then engaged the research team in envisioning a preferred future NMK. Envisioning, also known as 'futures thinking' (Tilbury & Wortman 2004) enabled us to build a shared vision of a sustainable NMK. The simultaneous critique of practices that constrain sustainability change and the envisioning of new possibilities for action resulted into 'team learning' (Senge 1990). Team learning is the basis for *organisational learning* and change for sustainability as argued in this paper.

In what follows I first outline the contextual issues related to sustainability change at the NMK and then highlight key features of the visions that were generated by the research team on a preferred future NMK.

Contextual issues related to sustainability change

The contextual issues that constrain sustainability change at the NMK are associated with poor governance systems at the organisation. Governance systems have been described by Doppelt (2003, p. 78) as “three-legged stools” that shape information flows; decision-making processes; and distribution of resources in an organisation. Essentially, changes in governance systems can provide the greatest leverage for sustainability change. As mentioned earlier, there are efforts to change governance systems through the ‘Museum in Change’ initiative.

The following are some of the issues that both constrain and enhance sustainability practices at the NMK:

- Departments are disjointed with some wielding more power than others.
- Existence of inappropriate policies on staff motivation, training and recruitment.
- Prevalence of poor communication and information flows.
- Limited participation of employees in decision-making processes.
- Uneven resource allocation and distribution with poorly defined budgeting systems.
- There exists a Museum Welfare Association (MUWA) that provides a forum for discussing sustainability issues such as social equity.
- There is a response to emerging social issues such as HIV/AIDS through peer education programmes at the organisation.

Envisioning a sustainable future NMK

The visions generated by the research team on a sustainable future NMK centred on sustained quality-oriented heritage conservation, improved information flows, improved working conditions and financial sustainability. Values, influences, opportunities and pathways associated with achieving a preferred future NMK were considered during the envisioning process.

The NMK was envisioned as a unique, accessible and dynamic world class centre in heritage conservation. Kenya’s heritage should be conserved in the context of the past, present and future towards sustainable development through collaboration with similar organisations. The organisation was envisioned as a responsive education and research centre that disseminated knowledge for the resolution of local environmental issues such as poverty and loss of biological diversity.

On information flows, the NMK should become an organisation where information was easily accessible. Improved information flows would motivate employees to be more innovative and productive. The NMK was also envisioned as a growing organisation with less dependence on donor funding and a pleasant place to work at. Financial and human sustainability were considered as vital features for a preferred future NMK.

Nine critical interacting components were identified as pillars for a sustainable future NMK. They are: motivated and competent top leaders; a committed and competitive board of directors; highly qualified and motivated staff; dynamic and responsive public programmes; cutting edge research;

steady revenue generation; an improved mandate and revised legal framework; adequate facilities; and supportive general public and partners.

Reviewing and altering basic assumptions

Basic assumptions are unconscious, taken-for-granted beliefs, perceptions, thoughts and feelings that are the ultimate source of values and action (Schein 2004). They are the 'theories-in-use' (Argyris & Schön 1996) that were implicit in the way the research team members perceived, thought and felt about sustainability change at the NMK. Underlying basic assumptions at the NMK were reviewed and surfaced through processes of dialogue, *critical thinking* and *critical reflection* (Brookfield 1990) with the research team. The assumptions may be thought of as the NMK 'cultural paradigm' or worldview (Schein 2004). Some of the assumptions that we have surfaced are:

- Information is power, informed individuals are more demanding in terms of asking for their rights; therefore its flow should be controlled from the top through occasional circulars and memos.
- The basic work of the NMK is the conservation of Kenya's natural and cultural heritage through research and dissemination of knowledge for the benefit of humankind.
- The top management administers, develops and controls the functions of the NMK on behalf of a Board of Directors.
- International donors and the government are the ultimate source of funds for research and development.
- Research departments are capable of working in isolation and take the responsibility of seeking funds to run their activities.

The process of surfacing, reviewing and altering basic assumptions at the NMK was a form of 'cultural analysis' (McLaren 2003) that generated knowledge, shaped values and enabled team learning. I now examine how we altered the first basic assumption stated above, through improving information flows at the NMK. Improving communication and altering information flows is a high leverage point for sustainability change in organisations (Doppelt 2003).

Improving information flows to enable cultural change

Poor communication and information flow at the NMK is a deeply ingrained problem that has to be addressed for cultural change to be enabled. Some of the root causes include fear of the unknown, lack of confidence, lack of trust, poor feedback mechanisms and government bureaucracies. Improving information flows necessitated altering the basic assumption that stated: *information is power, informed individuals are more demanding in terms of asking for their rights; therefore its flow should be controlled from the top through occasional circulars and memos*. We therefore reconstructed new basic assumptions and values on communication as follows:

- A newsletter is a basic tool for improving communication; revitalising the defunct NMK should become a priority.
- It is the responsibility of all employees to improve communication in the organisation.
- Improving infrastructure without addressing the communication issue will not bring cultural change.
- Trust and commitment within employees is a reflection of good communication.

- Voicing one's opinions even if they are dissenting to those in top management is an element of good communication.
- Communication is at the centre of every organisational change process for it is through this that dialogue is fostered.

Based on the above reconstructed basic assumptions, several strategies for improving communication and altering information flows were generated. These were critically reviewed and prioritised for action within our scope. The following four strategies were considered for implementation:

- *Revitalising the NMK newsletter.* At the moment, NMK has no functional staff newsletter that can serve as a communication tool. Although a newsletter is a one-way mode of communication, it has the potential of uniting employees. In addition to revitalising the newsletter, establishment of a communication and resource centre was proposed.
- *Increasing information flow pro-actively.* NMK employees should be encouraged to obtain information pro-actively and also read circulars. This will ensure that the information in the circular gets to everybody concerned.
- *Frequent briefings by the senior management.* This will provide face to face contacts between management and employees. This strategy has the potential to eliminate rumour-mongering and encourages timely dissemination of information.
- *Use of other modes of communication such as the internet.* This will minimise use of paper and hasten information flow at the organisation. Use of the internet increases the chances of messages being read since the computer is a tool of work.

For each of the above strategies, we developed action plans aimed at improving information flows. Some of the plans are being implemented through the 'Museum in Change' initiative.

Shifts in thinking within the research team

The process of reviewing and altering basic assumptions related to poor information flows at the NMK led to team learning that would not have been achievable individually. The following *shifts in thinking* analysed from participants' critical reflections may be regarded as evidence for organisational learning:

- In enabling cultural change, one is not supposed to dwell on personalities but on systems. It is possible to make marginal changes that may result into major organisational changes when focusing on systems.
- Poor communication at the NMK is a systemic problem that should be addressed by all employees.
- Patience and tolerance are part of effective communication; sustainability change is tied to good leadership within an organisation.
- Having divergent views does not hinder effecting cultural change but a lack of dialogue will prevent it.

Conclusion

This paper advances a 'cultural perspective on organisational learning' and change for sustainability (Cook & Yanow 1996). The NMK has been viewed as both a cultural entity and a structure of communicative action. Empirical evidence on team learning was gathered to signify

organisational learning. Organisational learning for sustainability can therefore be regarded as the *shifts in thinking* that occurred within the research team as a result of cultural analysis and reflective understanding. The culture of an organisation has been described as its basic assumptions that become visible in its structures, strategies, espoused beliefs and values (Schein 2004).

I facilitated team learning in my role as an environmental educator to enable sustainability change in my own organisation. This has offered the research team and the NMK an opportunity to develop a new kind of *critical competence* that will not depend on any special theoretical knowledge or expertise with respect to achieving sustainability change. The cultural perspective that I have advanced supports the view that sustainability is an ongoing multi-dimensional learning process that seeks cultural change rather than a concept to be implemented (Tilbury 2004).

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A course for children during the school holidays on the theme of "Sustainable Development " at the Le Montet Botanical Gardens (Nancy - France).

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Introduction

The Nancy Conservatory and Botanical Gardens education service carries out a number of activities: guided tours, activities, exhibitions, talks, gardening and drawing courses, publications, designing educational resources and taking part in events.

During the school holidays, it organises "green workshops", courses for children lasting a week, during which they work in the mornings on a theme based on the plant world. The main aim is to learn about nature and to make children more aware of environmental protection and biodiversity. The approach is always scientific, recreational, artistic and sensory. Children can learn while having fun! Numbers are limited to 15 to give better supervision.

In February 2006, the theme proposed was sustainable development. The course, for children aged 8 to 12, was entitled "On ne va pas se Terre !", a play on the word "Terre", meaning "Earth", but sounding like "taire", meaning "keep quiet" – i.e. "We're not going to keep quiet!"). As the subject is a particularly complex one, we decided to work on certain themes such as biodiversity, water and recycling.

Aims

The main aim was to offer the children a few ideas for becoming young eco-citizens.

Overall aims: the courses help children to discover and learn more about their environment, to discuss ideas and express themselves on a theme, to think, create and spend a convivial week together

Learning objectives: this was not meant to be a botany course, but we introduced a few scientific ideas that participants may remember:

- Ideas concerning biodiversity
- Knowledge of a few threatened plant species
- The principle of biological control

Aims concerning sustainable development :

- To understand the threats to biodiversity
- To understand the notion of sustainable development
- To learn a few gestures to help save the environment
- To become aware of the work of the Conservatory and Botanical Gardens

Method

The aim was to offer a varied range of activities that were both educational and fun. We alternated between visits to the greenhouses, games, experiments and making things. The theoretical work was done at the start of the activities.

Each child was given an educational document that was used as a basic resource during the activity and was also taken home by the child so that he/she could have a written reminder, information and supplementary activities and a souvenir of the course.

How the course operated

Day 1 -> Introduction and making the children aware of the issues

Through a visit to the tropical greenhouses in the Botanical Gardens (and to the Orchid exhibition that was taking place at the time), the children were able to familiarise themselves with the Botanical Gardens, find out what they were and marvel at all the wonders of the plant world.

Children are always fascinated by the variety of shapes, colours and smells.

This fascination comes into play very quickly with youngsters, particularly when they see some of the most impressive plants, such as the orchids, palm trees, giant cactus and insect-eating plants.

The first stage before action is to raise awareness. This takes place through a sense of wonder and the feelings and emotions experienced in the face of something beautiful. We need to like something before we can understand it, and to understand before we act.

We spent some time in the greenhouse of the garden dedicated to plants under threat, and were able to explain what biodiversity meant. We were thus able to talk about the threats hanging over the plant world. We listed the causes of the loss of biodiversity: deforestation, pollution, natural catastrophes the introduction of foreign species, etc.

The useful plants greenhouse showed the children how important plants are, as they offer us a whole host of resources, such as foods and medicines. We need to protect them because they're beautiful, but also because they're useful and even vital to our lives!

The second part of the morning was given over to work on documents to gain an understanding of the dangers that exist on the planet, but also for man (access to water, to education).

We ended with an experiment on the recycling of materials. To help them understand what might happen to waste materials in nature, we buried various natural and other items in different pots: a lettuce leaf, a paper handkerchief, a drinks can and a glass bottle. This experiment is obviously not yet finished, but it will already have helped the children think about the possible impact of items left abandoned in nature.

Day 2 -> Water and recycled paper.

To help the children understand that water is a very precious resource, we carried out an experiment on water treatment. We talked about how we might obtain drinking water: decantation, filtering, etc.

Having talked about the problems of deforestation in the tropical greenhouses, we thought about what we could do to avoid wasting paper: printing on both sides, manufacturing recycled paper.

The children then made their own sheet of recycled paper and designed a vegetable print to decorate it.

We then had a team game in which the children had to answer a series of questions concerning their knowledge of or actions to help the environment.

Making recycled paper

Day 3 -> Recycling

We talked about waste sorting and recycling. Various recycled plastic objects were presented. We had asked the children to bring in some examples of recyclable waste. Having sorted through the mountain of recovered waste, they made their own personal models from recycled materials: little men, spacecraft and a whole range of toys were invented. Our children didn't need any expensive modern toys to have fun! A

few waste items, a bit of Sellotape and a tube of glue were quite enough to develop their creativity and keep them amused.

Day 4 -> Recycling. Planting

We finished our modelling with the recycled materials.

We wanted to plant a tree in the garden, but we were unable to because the ground was frozen, so we decided to plant some ferns in pots, which the children were then able to take home. This gave us an opportunity to explain the fact that some house plants eliminate the toxins in our home environment. This is a particularly important activity, as it allows the children to come into contact with soil and plants. It is also a symbolic action: planting rather than destroying, helping something germinate, seeing a plant grow, a plant that represents life, nature, the environment, a plant that offers us resources and helps us to breathe.

Day 5 -> Further games and an evaluation of the week

We played a little game to help the children think about their consumer habits. The children imagined that they were at the supermarket. What products are they going to buy? An eco-citizen should be looking to reduce packaging, choose products that have come from fair trading and eat fruit in season.

We also played a few other games: imagine the Earth in 50 years' time if we don't do anything today, find a slogan for the Earth, a calendar of ecological gestures.

We observed the results of the experiment on the decomposition of items in nature.

In the threatened plants greenhouse we read a story to help the children understand that every individual gesture can count. We took time to observe some threatened plants. The children could choose a plant and observe and draw it.

The week ended with a brief evaluation. We simply asked the children what they liked or didn't like, and what they had learned.

Each child left with his educational document, some souvenir photos of the week, the programme of future workshops, the plant and some objects made from recycled materials.

Evaluation

The first positive thing is the satisfaction of the children. Whatever they remember of the week, they had a lot of fun and enjoyed some very pleasant, convivial moments in the garden. Most of them had already visited or have registered for future courses.

Getting children to like the Botanical Gardens is already very satisfying!

The parents were also very pleased with the courses. In particular, they appreciated the quality of the supervision 2 instructors for 15 children, the beauty of the gardens, the varied programme and the documents that the children brought home.

The children's evaluations of the week provided us with little information about what they actually learned. All the children said that they really enjoyed the course. They all said that they liked everything (there was nothing they didn't like!). They particularly enjoyed the models made from recycled materials.

The parents were pleasantly surprised to sometimes see their children carrying on the activity in the afternoon: some of them emptied their bins in the sitting room to search for modelling materials!

One child said he'd learned nothing because he already knew it all, which is a good thing!

One child got a bit confused: "I learned that nature isn't protected".

One child (the youngest) had a mental block over the insect-eating plants that he had seen for a few minutes on the 1st day: "I learned that you shouldn't put your fingers in carnivorous plants!"

However, the course had its frustrations: it was too short for tackling difficult issues.

It feels rather pretentious to talk about sustainable development, especially with children of this age.

We were unable to clearly define the concept of sustainable development. The term itself is too complicated and abstract to be understood by children of this age. But that is just a simple problem of vocabulary.

The term “sustainable development” implies economic development that includes respect for man and the environment. It is the concept of development that is not easy to explain.

The terms “environment” and “biodiversity” were assimilated.

It would be more accurate to say that we ran a course on the environment or eco-citizenship.

We will be offering another course on this theme during the summer holidays for slightly older children. Other problems linked to the planet will be covered: the greenhouse effect, global warming, deforestation...

In addition, during each course, we will be attempting to offer activities to raise children’s awareness of sustainable development and biodiversity: explaining the threats to the peat bogs during a week on carnivorous plants, building insect shelters during a course on “creepy-crawlies”, studying biodiversity through the example of a fruit family in a course on citrus fruits, etc.

Engaging people in the Wechiau Community Hippopotamus Sanctuary in Ghana

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Abstract

The Wechiau Community Hippopotamus Sanctuary Initiative, a unique community-based approach to *in situ* conservation in Ghana is presented and discussed. The sanctuary covers an area of about 40 Km² along the banks of the Black Volta River and contains one of the two remaining populations of hippopotamus (*Hippopotamus amphibius*) in Ghana. There are also over 210 species of plants in the sanctuary many of which are rare elsewhere in Ghana and sanctuary may become a relatively undisturbed botanical reserve for the northern savanna zone in Ghana. The initiative to develop the area into a sanctuary was led by the traditional chiefs and the local people resulting in the establishment of the first community-owned and -managed large mammal conservation site in Ghana. The decisions and management of the sanctuary are made by a Sanctuary Management Board (SMB) which is made up of the local people and they take recommendations from Earthwatch- supported scientists who use the area as their ecological laboratory. The scientists used field ecological and ethnobotanical techniques, environmental education, training of the local people and provided financial support to facilitate the establishment of the sanctuary. The sanctuary is already bringing benefits to the project communities through the conservation and sustainable uses of their natural resources and the promotion of community-based ecotourism. The challenges in local management of the project and prospects in terms of conservation and development of the project communities as a result of the initiative as well as recommendations for future management are discussed.

1.0. Introduction

The Wechiau Community Hippopotamus Sanctuary initiative is a unique community-based approach to *in situ* conservation in the Upper West Region of Ghana to conserve the remaining unprotected hippopotamus (*Hippopotamus amphibius*) population in the Black Volta River. The sanctuary has a population of about twenty-four hippopotamus. The only other presently known population of hippopotamus in Ghana can be found in the Bui National Park which is under threat with the government's plan to develop a dam over the river for hydro-electrical power generation. It is anticipated that the present population of hippopotamus in the Bui National Park will migrate to the sanctuary when the dam is finally developed. The sanctuary is therefore the only viable refuge for this focal species in Ghana.

The Wechiau Community Hippopotamus Sanctuary initiative is a unique approach to *in situ* conservation in Ghana in that it is:

- a genuine community- based initiative led by the traditional chiefs and people with no national government involvement resulting in the establishment of the first community – owned and –managed large mammals sanctuary in Ghana,
- a collaborative initiative that is using conservation as a key element in bringing together people from diverse ethnic, cultural and religious backgrounds, and
- an initiative that is based on a long-term vision and therefore will take many years to yield its full benefit for the people. Such a long-term vision is often not common among poor people who have to focus on short-term activities that will sustain them on a daily basis.

2.0. Location and description of Sanctuary

The sanctuary is located at Wechiau about 42 Km southwest of Wa in the Upper West Region of Ghana and positioned on latitude 09°49'762 N and longitude 02°40'965 W. The sanctuary occupies an area of about 40 Km² along the banks of the Black Volta River and the vegetation type is Guinea Savanna. There is a rainy season between June and October and a long dry season from November to May in the sanctuary. The average annual rainfall and temperature ranges are 1034.1 mm per year and 11°C respectively. Hippopotamus (*Hippopotamus amphibious*) is the keystone species in the sanctuary area both from the point of view of conservation and ecotourism.

The sanctuary involves 22 villages and settlements made up of largely the Wala and Brifo people with an estimated population of 8700 people in the sanctuary. The Wala people are the landlords of the area and the Birifo are considered as settlers from Burkina Faso. Three main religious groups: Muslims, Christians and believers of traditional religion are found in the sanctuary. The chief of Wechiau (Wechiau Naa) is the Paramount chief of the traditional area and all other chiefs are divisional chiefs under his authority. The people living in the sanctuary are largely farmers, hunters, cattle herdsman and fishermen. Crops cultivated are mostly food crops such as Bambara beans, corn, millet, guinea corn, groundnuts and yams, and cash crops such as cotton and tobacco.

3.0. History of the Sanctuary

The history of the Wechiau Community Hippopotamus Sanctuary dates back to the 1990s. Two studies on the status of *Hippopotamus amphibious* in the Black Volta recommended for the establishment of a government managed reserve at the Wechiau traditional area to conserve the hippopotamus population (Choribe, 1990; 1997). This recommendation was however rejected by the landlords, as they were scared that government would take over and alienate them from their own land.

In August 1997, a team led by the Executive Director of Nature Conservation Research Center (NCRC), Mr. John Mason, with personnel from the Ghana Wildlife Division and Ghana Tourist Board visited Wechiau to dialogue with the Chiefs and opinion leaders about developing the potential of the hippopotamus population within their area. Further series of meetings and discussions between staff of NCRC and the Paramount Chief of Wechiau Traditional Area, Na Bayon Doguah II, the sub-chiefs and opinion leaders culminated in an agreement to develop the area into a community-based sanctuary. The chiefs and people were very motivated because they will still own their land and accrue direct benefits to their communities for infrastructure development whiles contributing to the conservation of their natural resources.

Following the acceptance of the concept of a community-based sanctuary, the Paramount Chief and his people formally requested for technical assistance from NCRC to assist in the

establishment of the sanctuary. In December 1998, NCRC posted a sanctuary advisor to the area to begin working with the project communities to lay the foundation for the sanctuary. The collaborative effort of the project communities and NCRC gained support from the Wa District Assembly (local government).

In early 1999, an old building in Wechiau was refurbished to serve as the visitor information Centre using an existing community fund. The sanctuary advisor also facilitated the formation of a Tourism Development Committee (TDC) to be in-charge of tourism and it was made up of only members from the landowning tribe. The landlords did not want the settler groups to be part of the TDC. The paramount chief of the area also declared that all human activities other than fishing were prohibited within 2km along the Black Volta River and farmers were allocated alternative lands outside the area. The TDC received a small grant from Peace Corps Ghana in 1999 year to begin a four –room lodge within the sanctuary for tourists. In that same year, Calgary Zoo Conservation Fund also provided funds to undertake a reconnaissance survey to begin planning the sanctuary and to demarcate areas. Shortly after the survey, the TDC was later reconstituted into a Sanctuary Management Board (SMB) with the mandate as a decision making body and made up of largely community members from the 22 villages and non-official representatives of stakeholders such as NCRC and Ghana Tourist Board (GTB).

4.0 Earthwatch expeditions

In the year 1999, NCRC secured funds from Earthwatch Institute (UK) for a multidisciplinary team of scientists to conduct detailed ecological baseline studies on plants, birds, mammals and reptiles in the sanctuary in order to generate information for the management of the sanctuary. The recommendations from the Earthwatch-supported scientists were to be used by the SMB with the technical assistance of NCRC to ensure that management decisions have rigorous scientific basis. The first Earthwatch expedition to the area was in June 2000. It was the Earthwatch expeditions that really facilitated the establishment of the sanctuary. The Earthwatch-supported scientists used the following methods to facilitate the establishment of the sanctuary.

Field ecological and ethnobotanical techniques

The Earthwatch-supported scientists used rapid standard ecological census techniques and community participatory ethnobotanical techniques to collate information on the plants and animals in the sanctuary, and the uses of plants to the local people. A number of local people were recruited from the project communities to serve as guides for each of the different taxonomic discipline and for them to gain a deeper understanding of nature. The first three years of the project (2000-2003) documented over 210 species of plants, about 200 species of birds, 16 species of bats, 26 species of rodents, 13 species of snakes as well as 6 species of amphibians in the sanctuary (EWI, 2003).

The sanctuary was therefore also found to be important for its botanical resources. Plant species such as *Heeria isginis* and *strychnos spinosa* that are rare in other parts of Ghana were common in the sanctuary. The sanctuary also contained species of plants that supported the livelihood of thousands of the local people by providing them with their sources of medicine, food, fuel wood, fodder, constructional material, crafts and tools (Asase and Oteng-Yeboah, 2005). Because annual bushfires impact on plant biodiversity in almost the entire northern savanna zone in Ghana, the sanctuary may become a relatively undisturbed botanical reserve in the area.

Environmental education

The Earthwatch funded expeditions was also very important in its environmental education. The scientists used the research results through environmental education in the form of welcome durbars and end of expedition debriefing to disseminate information on the species of plants and animals, and indicate threats to these plants and animals to the local people in the sanctuary. The chiefs and their people, members of the SMB, Earthwatch Volunteers and School children from the project communities attended the welcome durbars and end of expedition debriefing. A total of fourteen Earthwatch funded expeditions that involved 130 international volunteers were conducted in the first three-years of the project and the presence of these international volunteers at the sanctuary alone made a significant contribution in the facilitation of the establishment of the sanctuary. Environmental education through visits to schools and communities also ensured that the people were educated about the effects of indiscriminate bush fires, hunting of game and fishing in certain areas of the Black Volta as well as the values that they could derive from the conservation of natural resources through ecotourism.

Training of the local people

The Earthwatch expeditions involved the local people in a variety of ways especially as cooks, guides and boatmen. It provided a number of training opportunities for the local people especially as natural history tour guides. Two of the local people now serve as excellent tour guides for plants and birds in the sanctuary and one of them received a national tour-guide award.

Financial support

The accommodation fee paid by Earthwatch was used to pay for the daily expenses of the sanctuary and staff salaries. The funds from Earthwatch also enabled the SMB to construct an additional tourist lodge in the sanctuary. The local staffs on the Earthwatch funded project were also paid salaries at the end of each expedition. The financial support was a great motivation to the people to support the sanctuary activities.

One of the major outputs of the Earthwatch expeditions at the sanctuary was the five –year management plan for the sanctuary. The data from the Earthwatch expedition were very instrumental in the promulgation of the management plan. Earthwatch Institute further provided funds two years to support five activities in the management plan that were suitable for meaningful volunteers participation while NCRC was seeking grants to address the more expensive and technically difficult tasks within the management plan. The sanctuary management plan was used by the SMB in making bye-laws to regulate human activities in the sanctuary.

5.0. Funding and stakeholders

The sanctuary has also benefited from various organization to enable it perform its functions properly. The primary sources of outside funding for the sanctuary have been from Peace Corp Ghana, The Calgary Zoo and United State of America International Aid (USAID). Peace Corps Ghana provided the initial funds to establish the first lodge in the sanctuary. The Calgary Zoo supported the initial salaries for the sanctuary from 2000-2001, and provided equipment such as bicycles, uniforms, safety boots and cutlasses for the sanctuary Rangers. The Calgary Zoo society also raised funds from its members to support education programs sponsored by the sanctuary, and to provide the professional assistance of an on-site education specialist.

USAID funds have supported the development of facilities such as Visitor Center, refuse containers, safety equipment, marketing materials like brochures, posters and t-shirts, and capacity building initiatives like tour guiding training, tourism awareness sessions and financial management training.

Other stakeholders providing material and technical support to the sanctuary include the Ghana Tourist Board and the Wa Municipal Assembly.

6.0. Achievements and prospects of the Sanctuary

The Wechiau Community Hippopotamus Sanctuary has begun to generate real returns from visitors and researchers. For instance in 2003, the sanctuary generated \$6230 from tourists. All funds generated from the sanctuary go into the SMB account and this is used to pay for the salaries of staff, maintenance cost and community projects. In this way, the sanctuary has directly provided employment to about ten local people who are engaged as guides and cooks in the sanctuary. A large number of the local people have also benefited indirectly through the sale of crafts, hiring of vehicles and bicycles. The sanctuary has also been able to sponsor four boreholes in four of the project communities to provide them with portable source of drinking water. This is a significant contribution, as many of the communities within the sanctuary do not have sources of portable drinking water. The District Assembly has also renovated and constructed roads and culverts linking some of the sanctuary communities making some of the remotest communities in the sanctuary now very accessible to health centers, schools and for marketing activities.

The sanctuary has already attracted the attention of many researchers and students who have used the area as their field research site. A number of students have successfully conducted their theses research work in the sanctuary working closely with the local people (Donahue, 2003; Asase, 2004). The University of Calgary also adopted the sanctuary area for their summer Biological Field School in Ghana in 2001. There are still many opportunities for research in different disciplines such as Anthropology, Aquatic Biology, Sociology, Ethnobotany and Wildlife.

The sanctuary has also attracted the attention of both local and international media with print and electronic pieces appearing on British Broadcasting Corporation (BBC), Canadian Broadcasting Corporation, Ghana Broadcasting Corporation (GBC), Sunday Times (UK), Sankofa (Netherlands), Daily Graphic (Ghana), Calgary Herald and Ottawa Citizen (Canada). It is hope that the tourism potential of the sanctuary will therefore increase and more revenue will be obtained for the development of the area.

7.0. Challenges facing the Sanctuary

Despite the above achievements, the sanctuary still has a number of challenges. One of the major challenges facing the sanctuary is recurrent annual bushfires. These annual bushfires often destroys the habitat of a variety of animals as well as their sources of food and also impact on the vegetation. Although environmental education has assisted drastically in reducing the extent of bushfires in the area the situation is still disturbing.

Fishing in the Black Volta is another important challenge for the SMB. Fishing nets are usually laid across the width of the Black Volta River accompanied by excessive noise making especially in the dry season and this obstructs and disturbs the free movement of hippopotamus leading to human-hippopotamus conflicts. The sanctuary is facing challenges in stopping other old habits such as hunting of small game.

The implementation of the bye-laws and regulations established by the SMB for ensuring the protection of ecologically sensitive areas of the sanctuary has not been very effective. Many of the people who go against the sanctuary bye-laws are usually family relations of the SMB, which make it difficult to apply sanctions on them.

The long-term goal of the SMB is to fund all expenses and development needs of the sanctuary through its tourism revenue. However, the sanctuary is still a relatively new project and is facing financial difficulties since the Earthwatch expeditions that used to be one of their major sources of revenue have also come to an end.

8.0. Recommendations for management

There is a need to still continue with environmental education in the sanctuary to enable the community members fully appreciate the benefits that they can obtain as a result of conserving the plants and animals in the sanctuary. The SMB could also do early controlled burning in the sanctuary so that the effects of bushfire on the flora and other resources will be minimal. Alternatively, the SMB could consider making green firebreaks that will protect core areas of the sanctuary from burning. Regular patrols by the sanctuary Rangers should be carried out to check incidences of bushfires and also hunting for game and fishing in certain portions of the Black Volta River. The SMB should also grow seeds and propagules of plants that were collected during the Earthwatch expeditions in degraded areas of sanctuary. To generate more revenue for the sanctuary, the SMB should start to put labels on the plants containing information on the local names and uses of these plants. This will increase the number of options that a tourist visiting the area would have.

9.0. Concluding remarks

The Wechiau Community Hippopotamus Initiative has developed rapidly and has created multiple opportunities for sharing lessons learned with other parts of West Africa and the rest of the World. The Wechiau approach allows local communities to plan, manage and benefit from their natural resources through ecotourism and is a pioneering example of practical community – based conservation in West Africa.

Acknowledgments

We are most grateful to the project communities and SMB and all the stakeholder of the Wechiau Community Hippopotamus Sanctuary. We are also grateful to the entire staff of the Earthwatch Funded Project and staff of NCRC. Thanks to Earthwatch Institute (UK) for their funding, this made the difference. We also thank Earthwatch Institute for providing funds to enable Dr. Alex Asase attend this congress.

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Presenter biography

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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 Apprenticeship 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.

Building awareness of education for sustainable development in Russia's botanic gardens

Dr. Alla Andreeva

Moscow University Botanic Garden ("Apothecary Garden")

Introduction

The concept of Education for Sustainable Development arrived in Russia relatively recently, and there is still no officially approved ESD strategy. Debate on the principles, aims and objectives of ESD is leading theoreticians and practitioners (philosophers, sociologists, environmentalists, psychologists and culture studies experts) towards an understanding of the significant role that botanic gardens can play in this process.

Garden-based education began to attract attention following the adoption of the International Agenda for Botanic Gardens in Conservation in 2000, which defined ESD as a priority activity. The gardens themselves, however, have been slow to get involved. There are several reasons for this:

1. Traditionally, the role of Russian botanic gardens has been to provide excursions for university students and school pupils;
2. Garden managers and specialists often fail to understand the need to develop new educational principles: they appreciate neither the difference between the new approaches and the traditional methods, nor the social benefits to be gained by change;
3. The willingness to develop new educational programmes may be there, but there are few specialists capable of doing this independently;
4. The gardens need to introduce new funding and administrative policies to create a platform for implementation of the new strategy.

However, with the assistance of international grant programmes and the financial support of major companies promoting ESD in Russia – notably BP - some gardens have been successful in launching projects based on the new principles. Best practices were shared at Russia's first national conference on environmental education, held in May 2003 with the participation of Peter W. Jackson and Adam Adamou from the BGCI. These successes have generated interest amongst Russia's garden community and have created precedents. One practical outcome of the conference was the establishment of an ESD Commission under the Council of Botanic Gardens of Russia.

In the last year or two we have seen a major turnaround in attitudes towards the whole subject, largely thanks to support from the BGCI and the Council of Botanic Gardens of Russia.

Projects and activities

An important role in this process was played by a joint project between Moscow University's Botanic Garden and the BGCI as part of the SEPS-3 programme funded by the UK's Department for Environment, Food and Rural Affairs (DEFRA) and led by the British Council. The project

was entitled “Realizing the Potential of European Russian Botanic Gardens to Deliver Education for Sustainability to Teachers and School Children” (2004-2005)

Project Objectives:

- To inform botanic garden management and staff of the philosophy behind Education for Sustainability and demonstrate its importance and benefits.
- To involve the botanic gardens of European Russia in delivering Education for Sustainability to school children.
- To encourage contacts between botanic gardens and local schools, local environmental protection committees and NGOs.
- To involve local schoolchildren and teachers in environmental educational programmes and practical nature conservation activities.
- To develop a network of Russian botanic gardens.
- To set up a network of young peoples’ eco- clubs in botanic gardens, supported by a dedicated Young Ecologist Club web-site
- To strengthen links between botanic gardens in European Russia in the area of education

Workshops

The project included two workshops for botanic garden specialists on Education for Sustainable Development. These brought together specialists from various organizations in Moscow and other parts of Russia, such as Kemerovo in Siberia, Krasnodar on the Black Sea, Komi, Tver and Obninsk. In total, the workshops were attended by representatives from 15 Russian botanic gardens, selected by a questionnaire designed to assess their commitment to developing educational programmes.



One of the issues covered by the first of the two workshops in May 2005 was defining the difference between “Education for Sustainable Development” and “Environmental Education”.

The event was led by Julia Willison, Head of Education at BGCI, who introduced the participants to the new education strategy and supporting documentation, and demonstrated a range of exciting and successful teaching methods. The use of games in the classroom was of particular interest: participants were not only taught the theory, but became actively involved in the game playing process and the subsequent discussion of this approach and of how best to incorporate it in Russian gardens' current teaching programmes. A presentation on the UN Decade of Education for Sustainable Education (2005 – 2015) generated a lively debate, the garden representatives being keen to understand what role Russian botanic gardens could play in its implementation.

Many of the techniques presented at the seminar were included in a set of guidelines on organizing eco-clubs in botanic gardens, published as one of the project deliverables. The workshop also provided a platform for swapping experiences and developing new ideas.

In November 2005, a second workshop was held, based on suggestions from participants in the first seminar earlier that year. The topics covered included Evaluating Educational Activities, Fundraising for Education Projects, Basic Principles of Interpretation in Botanic Gardens, and Setting up Eco-Clubs in Botanic Gardens. The workshop also included a series of presentations on best practice in the most active Russian gardens, such as Tver State University Botanic Garden's experience of working with NGO's and fundraising, Irkutsk State University Botanic Garden's work with problem teenagers and Kemerovo Botanic Garden's programme for recultivating slag heaps, run in conjunction with schools and funded by local coal mining companies. There was also a fascinating presentation on interactive games developed by Moscow State University's Professor Kavtaradze.



The success of the workshop was evaluated by a questionnaire designed by the participants themselves and based on some of the assessment techniques covered during the course. There was unanimous support for making such workshops regular events: not only do they teach valuable new skills and techniques, but also promote teambuilding, partnerships and more effective networking between gardens.

The growing body of ESD experience in Russia has highlighted problems, while at the same time demonstrating clearly the benefits to be gained from ESD, including an enhanced role for botanic gardens in society and greater funding opportunities.

Publications and Internet Resources

The following ESD-based publications have all been produced over the past year:

- A Russian version of “Education for Sustainable Development: Guidelines for Action in Botanic Gardens” (BGCI, J. Willison, 2004);
- A manual on setting up ecological clubs in botanic gardens;
- A draft Declaration of Support for Education Programmes in Botanic Gardens based on the concept of sustainable development;
- Manuals on developing education programmes for schoolchildren and teaching biodiversity, sustainability and plant conservation, including an understanding of traditions and ways of using plants: “Useful Plants of the Tropics and Subtropics”; “Amazing Ferns of the Earth – Lessons in the Botanic Garden”;
- Advertising leaflets for the new websites.

All the above publications have been distributed to every botanic garden in Russia and can be downloaded from two dedicated educational websites:

<http://education.hortus.ru> – a site for environmental education professionals, sharing information on ESD experience in Russian botanic gardens, international ESD experience, and links to botanic gardens featured on the site.

<http://ecoclub.hortus.ru> - a Young Eco-Club website for children.

As a result of the above, the audience of schoolchildren engaged in conservation and research activities had increased many times over, not only in Moscow but also in the regions. There is now a stronger focus amongst the garden community on working with children and developing new education programmes using the new publications and new opportunities to exchange information.

The education site has provided garden specialists with a much-needed information resource, access to methodological materials and other electronic resources. Some gardens have been inspired to create websites of their own and there is a growing degree of public awareness of botanic gardens as potential environmental education centres.

T 14 meeting

In June 2006, a number of Russian botanic gardens, together with various secondary and higher educational organizations and NGO’s were represented at the T14 Russia’s meeting on “The Role of Education and Communication in Advancement of the Global Strategy for Plant Conservation”. This was held as a part of the *XII International Conference on Environmental Education - «SUSTAINABLE WORLD: ON THE WAY TO AN ENVIRONMENTALLY SAFE CIVIL SOCIETY»*.

The discussion centred around the status of plant based education in Russia and identified a series of actions for taking forward T14 (education and communication) of the GSPC among politicians,

scientists, educators and public groups. It became clear that not only do the gardens have enormous potential in this area, they already have specialists with experience in delivering plant based education and practical conservation activities. The meeting stressed that existing best practices need to be shared widely and a set of educational modules developed for schoolteachers to use in garden settings. This latter task is made all the more topical in view of the current trend to reduce the time dedicated to biology in the Russian school curriculum.

In this context it was agreed that a series of articles would be published by the schoolteachers' journal "Biology in Schools" showcasing the education programmes and methodologies practised in different botanic gardens. In addition, the Council of Botanic Gardens decided to compile a collection of articles on "Building Awareness of Education for Sustainable Development in Russia's Botanic Gardens", which will be published later this year.

Conclusions

Although the outcomes of all these activities are inevitably of a long-term nature, they have already created a platform for networking between Russia's botanic gardens in the areas of education and nature conservation, and have helped the gardens to become part of the international network under BGCi coordination.

Little by little, a team of Russian ESD enthusiasts has been formed, fired by initiative, optimism and a desire to learn new ways. We can therefore be confident that Russia's botanic gardens have a great future ahead of them and that before too long the results will be evident.

Biography

Dr. Alla Y. Andreeva

Moscow, Botanic Garden of Moscow State University

Coordinator of the environmental education programme; Deputy Chair of the Environmental Education Commission under the Russian Academy of Sciences' Council of Russian Botanic Gardens; Candidate of Biological Science, ecologist.

Currently working on the theoretical aspects of biosphere environmental education, ESD – education, educational programmes and methodological aids for teaching schoolchildren. Devises and conducts a course of thematic "Lessons in the Botanic Garden" and leads the Young Ecologists' Club in the Botanic Garden of Moscow State University ("Aptekarsky ogorod"). Author of more than 60 scientific publications and the textbook entitled "Nature Study. 5th Year" for general educational schools

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 by 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.

Public education in the Xishuangbanna Tropical Botanical Garden (XTBG), China, with particular respect to methodological contents

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Introduction

Learner-centered approaches challenge the traditional didactic view of the teacher as the person who determines what, when, and how learners will learn. Creation of an environment where students can learn effectively and efficiently becomes the new prerequisite, demanding not only teachers to be experts but also understand how people learn (Irby 1994).

Several authors have reviewed the evidence for learner-centered learning. Benefits identified include stimulated thinking and creativity (Jenkins 1997), promoted more stimulating deep and enjoyable learning environments, inter-discipline, and improved motivation, retention of knowledge (Spencer & Jordan 1999). We also found that learner-centered teachers are more successful in engaging all students effectively and are themselves more effective learners (Barbara 2001). Self-directed learning is suggested as the most efficacious for the continuum of education, particularly when it is based on experience with new knowledge and understanding integrated into the personal and professional context of the individual (Chastonay 1996).

The disadvantages for learner-centered learning, including the costs for starting up and maintenance (Berkson 1993), excessive demands on staff time (Des Marchais 1993), reduced acquisition basic sciences knowledge (Vernon 1993), relative inefficiency, and implementation difficulties when class sizes are large or a broad lack of enthusiasm for the approach (Albanese 1993).

Educators need to carefully cater instructional approaches to educational programs. The crucial role for an educator in a botanic garden is a facilitator. Good environmental education allows individuals to question, set goals and decide their own values and practices. The learner should be motivated, exposed to an appropriate learning environment and maintain interest in the learning material. Thus central question arises, “Is learner-centered methodology more efficient than teacher-centered learning for education within botanic gardens?”

Even though there has been much discussion on the methodology of public education in botanical gardens in China recently, very little information is documented and implemented. Present paper lay out the theoretical considerations, the practical findings and the evaluative criteria. Given the philosophical basis of current botanical-garden-based environmental education this study aims to discuss the rationality and the value of learner-centered approaches to the retained knowledge, implemented within the XTBG. Effectiveness of learner-centered education was tested from behavioral observation, questionnaires and interviews focusing on learners' reactions.

Research questions

1. Is learner-centered environmental education more effective than teacher-directed environmental education for the short- and long-term within the botanical gardens awareness of:

- a. scientific knowledge
- b. scientific method
- c. positive environmental attitude:
 - i. Awareness of more global environmental issues.
 - ii. More concrete basis for possible environmental action.
 - iii. Increase in emotional connection to the environment.

Methodology

Study Site

The research was conducted in Xishuangbanna Tropical Botanical Garden (XTBG), Yunnan Province, southern China. XTBG is the largest botanical garden, and has the richest plant collection in China. About 10,000 species of tropical and subtropical plants from China and abroad flourish here. In its capacity for public science education and as first-class nature tourism, XTBG attracts about 500,000 visitors each year.

Program 1: Learner-centered vs. teacher-centered

Participants

Junior grade 1 participants from a local school comprising, 21 females and 19 males, aged between 13 to 15 years belonging to various ethnic groups participated in the program 1. They were randomly divided into two groups for 2 programs.

(A) teacher-centered group (B) learner-centered group.

Facilitators

Six colleagues from Department of Public Education of XTBG cooperatively created the program and implemented in March, 2005.

Intervention (Treatment)

Theme: Why does the *Clock-Flower* open at the same time every morning?

Group A: learn through direct-teaching

Group B: observe and discuss flower behavior

Table 3. Overview of Program 1

GRO UP	No. OF PARTICIPA NTS	TIM E	SITE	METHOD	CONTENT AND COURSE
A	20	2 h	Class	PowerPoint interpretation---- teacher-centered education	basic structure of flowers, hypothesis provided by facilitator, “Why does the clock- flower open at the same time every morning?”
B	20	2h	Outdo or educat ion	Question- centered, self- observation, discussion and cooperative learning---- learner-centered education	Direct observation of clock-flower opening, hypothesis with same question raised by participants, workshop discussion

Program 2: Learner-centered Education

Participants

Forty participants, 20 females and 20 males of age between 12 to 16 representing various ethnic groups from 4 local schools, participated in the *Program 2*. They were randomly divided into five groups to ensure comfortable learning and sharing. Discussion benefited all the students, leading to critical thinking.

Facilitators

Same as for group 1 (program implemented in May 2005).

Intervention

The environmental education *Program 2* was a series of five activities, games, and reflections (Table 2). In the end, participants made a short journal entry.

Table 4. Overview of Program 2

ACTIVITIES	OVERVIEW
Plant “Discovery”	Search for the plants, indicated and labeled on the garden map. Answer correlative questions. <u>Goal</u> : self-discovery of interesting plants, stimulate awareness of collaborative research.
Body Language Art-Play	Cooperative body language to imitate several representative plants or phenomena in tropical rainforest. <u>Goal</u> learning characteristics of tropical rainforest and stimulation of imagination, and creativity.
Photography	Participants took photographs and appraise through comparison. <u>Goal</u> : to discover beauty, value nature, and explore an emotional connection to the environment.
Painting on the Ground	Using deadwood, defoliation, stone etc. found in the garden to create art on the grassland. <u>Goal</u> : to stimulate imagination and creativity, enforce bonding between man and environment.
Performance- Party	Use multiple performance methods to represent participants learning during activities. All performances were designed and performed by Participants. <u>Goal</u> : to explore the human impact on the environment, stimulate imagination and creativity and foster self-reflection.

Data collection and analysis

Quantitative Data

Different categories of questions (knowledge, methods, and attitude) were randomly divided into three sheets. They were filled in before the program, immediately after, and several months after the implementation of the program, to compare the mean differences of participants' environmental knowledge, methods and attitudes, of two treatment groups.

Knowledge-agree/disagree; methods-yes/no, an open-ended question; attitude-five point scaling “very agree” to “very disagree”.

Qualitative Data

Facilitators wrote observations during the program. After the program, the facilitators brought their ideas together for focused discussion. They agreed upon common themes that emerged from the qualitative data.

Results and discussion

All statistical analyses (nonparametric test and set the significance level at 0.05) done using SPSS 13.0.

Program 1: Learner-centered vs. teacher-centered

Quantitative Analysis

Group A:

Comparing three components (several related samples test):

Knowledge: $P = 0.009$

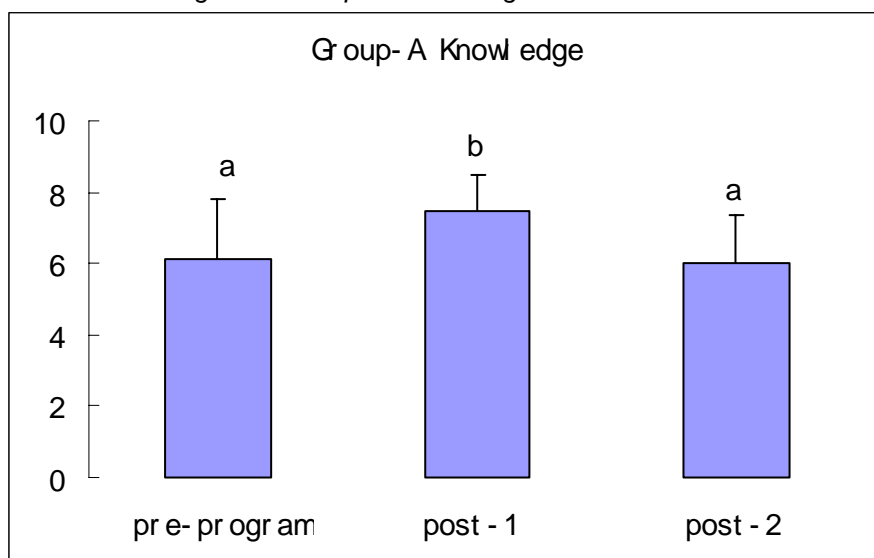
Method: $P = 0.622$

Attitude: $P = 0.167$

For knowledge (2 related sample test; Figure 1), significant differences were found between pre-program and post-1 (immediately after), but there was no difference between pre-program and post-2 (6 months later). Teacher-centered education has a positive effect on knowledge about the behavior of the clock-flower for participants. Immediately after the program, the score significantly increased ($P < 0.05$), but 6 months later, the score decreased greatly and reached to scores before the program. Participants learned from the teacher's presentation rapidly, but could not retain latter due to lack of self culture.

For method and attitude, no differences were found among three periods: Teacher-centered education program did not result in significant and positive educational changes in scientific method and environmental attitude.

Figure 1. Group-A Knowledge



Group B:

Comparing three components (several related samples test):

Knowledge: $P = 0.09$

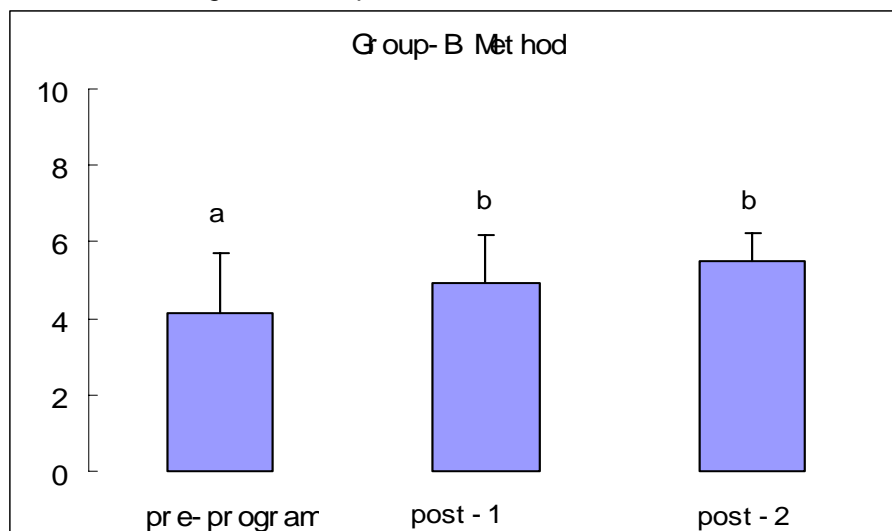
Method: $P = 0.015$

Attitude: $P = 0.012$

For knowledge about the clock-flower, no differences were found among three periods. However, in Group A, the knowledge we detected in the questionnaire, existed within the facilitator's presentation. So Group A could give answers more easily than Group B. The questions we used to detect the changes were possibly inadequate.

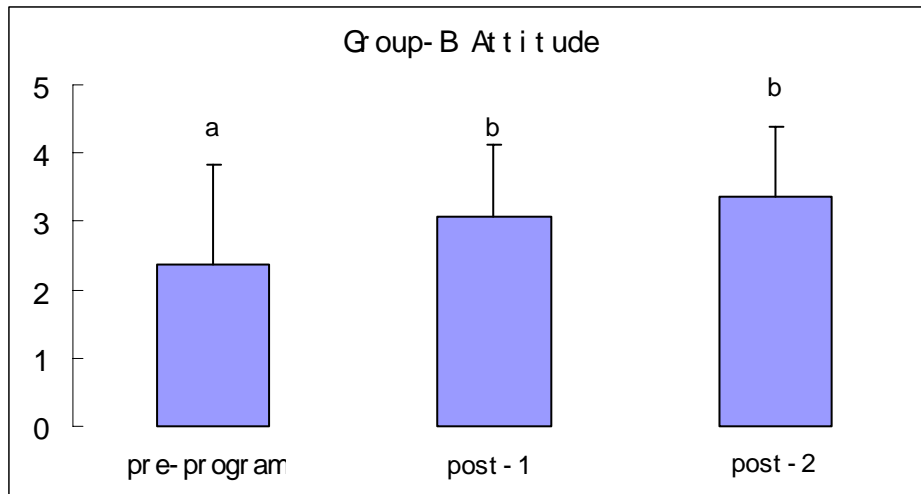
For methods relating to how to learn (2 related sample test; Figure 2), significant differences were found between pre-program and post-1 (immediately after) ($P = 0.01$), and there were significant differences between pre-program and post-2 (after 4 months later) too ($P = 0.01$).

Figure 2. Group-B Method



For attitude relating to plants (2 related sample test; Figure 3), significant differences were found between pre-program and post-1 (immediately after) ($P = 0.01$), and there were significant differences between pre-program and post-2 (after 4 months) ($P = 0.05$).

Figure 3. Group-B Attitude



Inquiry-based learning with the skills necessary to use scientific inquiry to gain better understanding of their natural environment, participants began to learn how to pose open-ended questions. This could lead to and form the foundation for investigation and experimentation. As student-participants acquired skills in the use of tools from the natural and social sciences, such as scientific equipment and interviewing techniques, they also learned more about the environment. Group B had natural experience.

Program 2: Learner-centered education

Quantitative Analysis

Tests for several related samples and 2 related sample test in a group

Comparing three components (several related samples test)

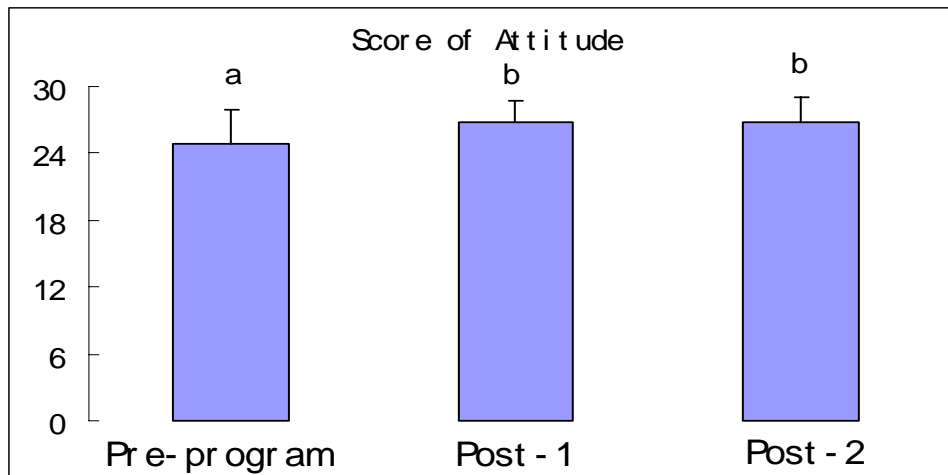
Knowledge: $P = 0.221$

Methods: $P = 0.063$

Attitude: $P = 0.005$

For attitude (2 related sample test; Figure 4), significant differences were found between pre-program and post-1 (immediately after) ($P = 0.01$), and there were significant differences between pre-program and post-2 (after 4 months later) ($P = 0.01$).

Figure 4. Score of Attitude



In the program, participants were skilled and provided with various opportunities to feel, learn, and interact with the natural environment. We believe that these enriched and diverse experiences were an essential factor in the expansion of the participant's knowledge, formation of environmental pro-attitudes, and the acquisition of elaborated, environmental friendly behaviors. But in this evaluation, we were not able to detect the expansion of knowledge. The tool we used for evaluation needs further improvement

Qualitative Analysis

The qualitative data from interviews show that the participants in the Learner-centered group expressed stronger interest in the program than in Teacher-centered group. They raised many questions and were more active in the program. After the program, most of participants in the Learner-centered group expressed the desire to attend more programs in the future.

Conclusion

Learner-centered teaching is more effective than Teacher-centered teaching to lend a durable awareness of positive environmental attitude.

Program 1: Teacher-centered teaching is beneficial for gaining knowledge, but with short retention. .

The use of Learner-centered Education program resulted in a durable, significant and positive educational changes in methods and attitudes. However, the effectiveness of the knowledge gained is less than that of teacher-centered teaching.

Program 2: Learner-centered teaching is beneficial for formation of attitudes of long duration compared to knowledge retention. This program proved to be a positive learning experience for both participants and facilitators. Participants' showed evidence of amplified environmental awareness: they developed different perception than of regular classroom.

Deficiency

There are many shortcomings within this study. One of the biggest limiting factors of this

program was lack of experience for evaluation. Questionnaires need to be improved.

Implications for future practice and research

- a) Botanical gardens are an informal learning environment, based on diverse plant species and beautiful landscapes. Therefore, the aim of public education should focus on stimulating interest in natural sciences and offering diverse learning challenges.
- b) Design of environmental programs should be improved according to principles of learner-centered teaching in order to accommodate diverse student backgrounds (eg. ages, ethnic groups, culture, and educational status).
- c) Use of various methods of evaluation to form sophisticated evaluation systems.
- d) Providing participants with environmental problem-based situations to analyze their reaction.
- e) Conduct more research on the effectiveness of environmental education programs.

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