Education for Sustainable Development:

Guidelines for Action in Botanic Gardens

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Contents

Introduction

'Shoots with Roots' is a hands-on education programme run at the Milner Gardens and Woodland, British Columbia, Canada. School children (Shoots) and staff and volunteer mentors (Roots) learn together during food gardening and woodland experiences. To date, over one thousand 'Shoots' have participated in the programme. For the first time in 2005, students were granted special 'Research Permits' to collect native plants and begin a Shoots with Roots herbarium. Photo: Charlene Forest, Milner Gardens and Woodland, Canada

The last 25 years have seen a growing awareness of environmental issues. While the very complexity of the problems we face has become clearer, there is also evidence that governments at all levels are starting to address some of these urgent issues. This development has corresponded with a worldwide renaissance in botanic gardens. Conservation organisations, private corporations, and governments alike are realising that gardens have valuable collections and expertise that can contribute significantly to sustainable development. One area where their contribution is likely to be invaluable is in the field of education.

These guidelines have been produced in recognition of the pivotal role botanic gardens have to play in Education for Sustainable Development (ESD). They complement the guidelines produced on Environmental Education in Botanic Gardens (Willison and Greene, 1994) and the International Agenda for Botanic Gardens in Conservation (Wyse Jackson and Sutherland, 2000).

“ There are solutions to the major problems of our time; some of them even simple. But they require a radical shift in our perceptions, our thinking, our values. ”

(Fritjof Capra, 1996)

Promoting healthier eating among the Pacific Island community is the focus of a programme run by Auckland Botanic Gardens, New Zealand. The gardens run training courses for teachers from the Pacific Island Early Childhood Development Centres and teachers from Cook Island, Niuean, Samoan, Tongan and Maori ethnic groups. As a result of the training, teachers and children have established sustainable food gardens at their centres. As well as fruits and vegetables the teachers are also encouraged to cultivate traditional Polynesian plants. This has proved to be an effective way of connecting people with their culture and heritage.

There has been a growing interest in ESD by botanic garden educators over the past few years: BGCI's international education review, Roots 17 (1998), was devoted to ESD and the past three BGCI education congresses (1996, 1999 and 2002) included ESD as a major theme. These guidelines have been developed as a response to this interest. They have been extensively commented on by colleagues working in botanic gardens and related fields and it is a testimony to them that they are now published.
The aims of these guidelines are to:

- Provide a rationale for why botanic gardens need to be involved in ESD.
- Offer guidance to botanic gardens setting up ESD programmes.
- Highlight the importance of botanic garden education in implementing sustainable development aspects of major international strategies for biodiversity conservation – Agenda 21, Convention on Biological Diversity, International Agenda for Botanic Gardens in Conservation, Global Strategy for Plant Conservation.
- Emphasise the contribution botanic gardens can make to the United Nations Decade of Education for Sustainable Development.
- Equip botanic gardens with a document that can be used to support their efforts in raising funds for ESD programmes.

The guidelines look at what botanic gardens have to offer ESD and the challenges they face, recommending that when developing an ESD strategy, gardens should:

- Identify who should be involved in developing a strategy
- Identify their target audiences
- Agree on their own institutional definition of sustainability
- Incorporate the foundations of ESD into their programmes
- Decide on the learning goals and themes
- Adopt appropriate educational approaches and resources
- Use a range of evaluation techniques

The guidelines also recognise that botanic gardens have the potential to become models for sustainability and offer a process by which this may be realised. It urges gardens to develop collaborative partnerships for ESD with relevant organisations on a local, regional, national and international basis.

These guidelines represent a contribution by BGCI to the implementation of the International Agenda and through it the achievement of the targets of the Global Strategy for Plant Conservation (CBD, 2002), in particular:

- Target 3 - Developing models of protocols for plant conservation and sustainable use.
- Target 12 and 13 - Using plant diversity sustainably.
- Target 14 - Promoting education and awareness about plant diversity.

ESD is an holistic process capable of addressing the environmental and development issues of the 21st century. These guidelines are designed to help gardens develop their thinking along such lines and contribute to sustainable living.

Green Treasures is a four year project run at the Fairchild Tropical Garden, USA. The aim of the project is to engage middle school students in learning about plants native to South Florida and the Caribbean. Students gather ethnobotanical information from older members of the community who hold valuable information about traditional plant use. This information is documented for use in exhibit interpretation and shared with the wider community. Photo: Eva Doll, Fairchild Tropical Garden, USA

Sustainability is a major theme that runs through both the International Agenda for Botanic Gardens in Conservation and the Global Strategy for Plant Conservation. Botanic garden education is key to its delivery.

Background

Few would dispute the fact that the world is facing an environmental crisis. Problems range from habitat destruction and global warming through to acid rain and unequal access to environmental resources and services. The publication of the World Conservation Strategy in 1980 (IUCN/UNEP/WWF, 1980) focused public consciousness on the concept of sustainable development (Fien & Tilbury, 1998). Significantly it made causal connections between economic growth and environmental degradation and established the central role of education. In 1991, Caring for the Earth: a strategy for sustainable living (IUCN/UNEP/WWF, 1991) was launched as a follow up to the World Conservation Strategy. This document highlighted the importance of education in bringing about changes towards sustainable lifestyles:

> *Sustainable living must be the new pattern for all levels: individuals, communities, nations and the world. To adopt the new pattern will require a significant change in attitudes and practices of many people. We will need to ensure that education programmes reflect the importance of an ethic for living sustainably.* (IUCN/UNEP/WWF, 1991, p5)

These views were echoed at the Earth Summit in Rio de Janeiro, Brazil in 1992, which concluded that to adopt a new pattern of sustainable living it will require a significant change in attitudes and practices of many people at all levels: individuals, communities, nations and the world. Agreement was reached at Rio on a number of documents, conventions and processes, including Agenda 21 and the Convention on Biological Diversity. Agenda 21 attempts to provide a framework for sustainable development in the 21st century. This document emphasises the importance of national government in supporting local community initiatives to realise their own local Agenda 21 programmes. The Convention on Biological Diversity (CBD) aims to conserve the world's biological diversity, promote sustainable use of biodiversity and provide for the equitable sharing of benefits. Article 13 of the CBD obliges parties to 'promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity…'. To support Article 13, in 2002 the Conference of the Parties adopted a programme of work for a global initiative on Communication, Education and Public Awareness (CEPA). One initiative of this programme has been the creation of an electronic portal to disseminate information, list partner organisations and share case studies and best practices in CEPA (see appendix).

In 2002, the World Summit on Sustainable Development (WSSD) was held in Johannesburg, South Africa. In acknowledging that progress towards achieving sustainable development was slow, it sought to overcome the obstacles by reaffirming its commitment to the full implementation of Agenda 21 and the Millennium Development Goals – a set of eight targets aimed at reducing poverty and promoting sustainable development. The WSSD also stressed the importance of education for promoting sustainable development and recommended that the United Nations General Assembly adopt a decade of education for sustainable development. The decade is scheduled to run from 2005 to 2014.

Against this background, botanic gardens can be seen as important centres for education for sustainable development.

The link between botanic gardens and sustainability was first emphasised in the *Botanic Gardens Conservation Strategy* which stated that botanic gardens are 'an essential element in living resources conservation for sustainable development' (WWF, IUCN, BGCS, 1989). In 1994, BGCI published a set of guidelines on environmental education. These guidelines were designed to help gardens set up environmental education programmes to support the implementation of the major international strategies for biodiversity conservation and sustainable living (in particular The Convention on Biological Diversity and Agenda 21). Since the publication of the guidelines, there has been increasing recognition by people working in the field, that environmental education as it has been traditionally taught is not enough to stem the current environmental crisis. It needs to embrace a more holistic paradigm, one that incorporates the ecological, economic, social, cultural and personal dimensions of sustainable development and their inter-relations.

If botanic gardens are to commit themselves to sustainability then it is essential that their education programmes reflect the ethics of Education *for* Sustainable Development (ESD). ESD is a process that facilitates people reflecting and acting on those forms of technology and social organisation that will allow us to live sustainably with the rest of human and non-human nature (Huckle, 1996, 2001). The International Agenda for Botanic Gardens in Conservation (Wyse Jackson and Sutherland, 2000) stresses the need for botanic gardens to promote the sustainable use of biodiversity. It is the intention of these guidelines to support botanic gardens in this work.

Who are the guidelines for?

These guidelines are primarily aimed at:

- Those responsible for education in botanic gardens

They will also be of interest to:

- Directors of botanic gardens
- People with overall responsibility for botanic gardens – trustees, government policy makers and advisors, local authorities, university administrators
- Horticultural, scientific and administrative staff
- People who use the botanic garden for education – schools, colleges, universities, community groups, etc.
- People working in site-based education centres – e.g. national parks, biosphere reserves.

Russian botanic garden educators visit Tver State University Botanic Garden during a workshop organised by Moscow State University Botanic Garden. The workshop formed part of a two-year UK government funded programme to help Russian botanic gardens work with their local communities to become more aware of the importance of Russian biodiversity and understand the necessity of using plants sustainably. Photo: Alla Andreeva, Moscow State University Botanic Garden, Russia

“ Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. ”

(World Commission on Environment and Development, The Brundtland Report, Our Common Future, 1987)

Education for Sustainable Development

Encouraging public debate is the essence of the Big Answers to Big Questions programme run by the Botanic Gardens Trust, Sydney, Australia. The aim of the programme is not to preach but to empower the public to make up their minds about subjects such as 'Will the next world war be fought over water?' or 'Are genetically modified crops better than those doused with pesticide?'. Over 2,000,000 people were reached through debate, web and radio. Photo: Botanic Gardens Trust, Sydney, Australia

In 1987 the Brundtland Commission defined sustainable development as meeting 'the needs of the present without compromising the ability of future generations to meet their own needs.' However, the question of how this is brought about is open to interpretation and related to different ideological or political perspectives. Sustainable development is clearly complex, making it difficult to define education for sustainability. It may therefore be useful to consider how ESD is conceived by two major organisations:

- Education for Sustainable Development is an emerging but dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future. (UNESCO, 2004)

- Education for Sustainable Development (ESD) motivates, equips and involves individuals, and social groups in reflecting on how we currently live and work, in making informed decisions and creating ways to work towards a more sustainable world. ESD is about learning for change. (IUCN-Commission on Education and Communication, 2004)

ESD attempts to represent the complex and dynamic relationships between the natural and social sciences. 'The more we study the major problems of our time, the more we come to realize that they cannot be understood in isolation' (Capra, 1996, p3). While, many forms of education can be seen to influence ESD, such as peace, health, political, multicultural, citizenship, human rights, futures, etc (Najda, 1993), the origins of ESD can be found mainly in environmental education (EE) and development education (DE), emphasising both environmental sustainability and social justice.

From an environmental perspective, education is seen to play a role in creating a just and democratic society. Environmental issues are not separate from economic, political and socio-cultural issues. To be environmentally literate, people need to be able to make decisions and solve problems where the environment, science, technology and society come together. The teacher's role tends to be that of a facilitator organising critical and collaborative projects in negotiation with students and the community. Students work together and use available academic and popular/local knowledge to reflect critically on social problems and participate in action based projects. Education for Sustainable Development is not an agreed set of ideas which educators can tack on to existing thinking and practice to allow them to say 'we are doing sustainability' – it is a form of empowerment that generally requires a reorientation of the way we think.

What do botanic gardens have to offer ESD?

Kirstenbosch Botanical Garden, South Africa, is incorporated within The Cape Floral Region, a World Heritage Site. This is one of the richest areas for plants in the world, being home to nearly 20% of Africa's flora. The Fynbos vegetation, which is unique to the Cape Floral Region, contains some of the highest levels of diversity, density and endemism to be found in the world and the region has been identified as one of the world's 18 biodiversity hotspots. Photo: Adam Harrower, SANBI, South Africa

Botanic gardens are multifaceted and have a wealth of resources that can be used to develop ESD programmes. In particular:

- Botanic gardens house large varieties of plants. The fact that all life on Earth depends on plants makes botanic gardens ideal centres for helping people make the connections between the ways in which societies/social systems are currently organised (economically, politically, socially and culturally) and their impact on the sustainability of ecological systems.
- Botanic gardens are actively working to conserve plants and implement the various international environmental conventions and national responses to such international obligations. They are well placed to become models for sustainability.
- Botanic gardens are often situated near urban areas and are therefore potential pioneers of ESD among relatively large population groups, including communities that are deprived of contact with plants.
- Over 200 million people visit botanic gardens each year. This offers an opportunity for gardens to provide information to visitors about plants and sustainability.
- Historical botanic gardens offer a link between the past and the future. Uniquely they can explain the role botanic gardens had in plant collecting and the implications this has had on the environment. They can recover and apply lost knowledge in areas such as health and can demonstrate how gardens can adapt their roles to the 21st century.
- Contemporary botanic gardens need not be constrained by 'old' ways of thinking and can develop new innovative programmes for ESD and employ new green technologies.
- Botanic gardens tend to be permanent institutions, which means that there is long term continuity and often a store of goodwill between gardens and local communities enabling long term ESD programmes to be developed and monitored over time.
- Botanic gardens hold influential positions in society.
  - ▸ They offer taxonomic expertise, for example to support international environmental conventions (e.g. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)), land use planning and the identification of invasive species.
  - ▸ They decide which plants to research and conserve (e.g. The National Botanical Institute, South Africa bioprospects medicinal plants in South Africa to develop new medicines for treating neglected African diseases, particularly malaria and tuberculosis www.nbi.ac.za).
  - ▸ They cultivate wild plants to take the pressure off wild populations (e.g. Tam Dao Garden of Useful Plants, Vietnam, Dennis, 2000).
  - ▸ They decide what groups of people to work with (e.g. The Limbe Botanic Garden, Cameroon has set up demonstration plots to teach local farmers how to farm sustainably)
  - ▸ They choose what knowledge to make available to the public (e.g. Missouri Botanical Garden, USA has the world's largest database of plant information (TROPICOS). It contains fully web-searchable records for over 900,000 plant names and nearly 2 million specimens; a resource for plant researchers worldwide www.mobot.org).

Such choices affect the development of societies and the conditions of our environment. Botanic gardens clearly have a valuable contribution to make towards sustainable development. They can provide information, which can support the development of ESD programmes and share expertise with local people, helping them to make informed decisions about issues that affect their lives, for example the impact of genetically modified organisms on food supply.

Challenges

What are the challenges for botanic gardens?

Botanic gardens face many challenges in developing ESD programmes, for example:

- The majority of botanic gardens are scientific institutions and, as such, a key feature of their education programmes involves teaching about plants in a scientific context. Offering alternative perspectives in education is both a challenge and a new approach.
- Many botanic gardens are privately funded or financially supported by central or local government. Such funding is often inadequate and staff need to spend time seeking funds from other sources. In these circumstances staff may find that they do not have sufficient time to develop programmes for sustainability.
- Most people working in botanic garden education are not professionally trained educators or teachers. This leaves open the risk that botanic garden education is only seen as teaching people about plants rather than encouraging them to think about the implications of living more sustainably and modify their behaviour accordingly.
- Many educators believe that botanic garden education should be free from political controversy. But no educational activity is 'value free' and even an explicitly non-political programme may well implicitly condone the political and economic status quo. A lack of critical reflection may lead students to gain an unquestioning and simplistic view of sustainability.
- Students may only visit a botanic garden once during their school career. This leaves little time for meaningful interaction between the educator and the students, posing the question of whether education *about* sustainability is the only feasible form of ESD in botanic gardens.
- Teachers may have a set agenda when they visit a botanic garden with their students. The school curriculum tends to dictate their visits and they usually come with preconceived ideas about what they want to learn.

Meeting the challenges

Examples of ways in which botanic gardens can meet the challenges above include:

- Incorporating ESD into the mission of botanic gardens
- Botanic garden educators could run workshops for other garden staff to raise their awareness about the significance of all educational goals.
- The development of ESD programmes should be a priority for botanic gardens. Such initiatives underline the gardens' importance to the local communities and can open up new avenues for funding support.
- Staff running education programmes need access to on-going staff development and training.
- Educators should be encouraged to explore their personal and professional values and reflect on how these affect their educational programme. This could be done informally and formally through research projects and networks, for example.
- Gardens could develop long-term ESD programmes in collaboration with school and community groups
- Many gardens now have their own web sites. More gardens could take advantage of technology to reach a greater audience with ESD.

Directors and educators from all over Argentina took part in a national workshop in 2005 at the Cordoba Botanic Garden. During the workshop they explored interpretation, working with different audiences and environmental games. Communicating the importance of education to managers of botanic gardens and involving them in events and programmes can help to raise their awareness about the significance of education goals. Photo: Douglas Gibbs, BGCI

- Increased dialogue between gardens and schools is likely to help raise awareness of the types of ESD programmes gardens have to offer and how these can complement the school curriculum.
- Botanic garden educators could document their experiences through shared media such as websites, internet networks, special interest groups, journals (e.g. Roots, BGCI Education Review) and other publications.
- Gardens need to work more closely with their funders to raise awareness of the necessity of ESD programmes.

Developing an ESD strategy for your garden

Who should be involved?

For a botanic garden to reflect the ethos of sustainability, it should endeavour to ensure that everyone working in the garden is involved – trustees, director, education and scientific staff, horticultural and gardening staff, administrators, cleaners and friends of the garden. This might not be practical at the outset, but it should be the aim of gardens to involve all staff in developing ESD programmes. ESD is a dynamic and inclusive process, the more people involved the greater the potential for sustainability.

Who are we educating?

When deciding on target audiences for an education programme, botanic gardens have a wide range of people and groups to choose from (see BGCI's environmental education guidelines, p7). However, most gardens have limited access to financial resources and will not be able to provide education programmes for everyone.

Also the number of learners in a group will impact on the type of educational approach used. One way of prioritising your educational agenda is to focus on an environmental issue/s relevant to the garden and a particular target group. In deciding on which target group to work with, the following questions need to be addressed:

- What environmental issues are relevant to the garden and particular target audiences?
- Which target group is willing and able to contribute towards finding and implementing a solution?
- Does the garden have the resources to develop an appropriate education programme for them?

By selecting target groups in this way, botanic gardens can become more focused in empowering groups to resolve environmental issues.

Hallmarks of Good Practice

Have clear objectives:
If you don't know what you're trying to achieve, why are you doing it?

Get the process right:
Successful educational experiences do not (usually) happen by chance; they are a result of thorough research, targeting, planning, execution and evaluation

Offer experiences that are relevant to your audience
Know your audience and start from where they are

Get the style right:
Develop activities that stimulate and are fun

Build in progression:
Have a clear idea of where you are taking your audience, ideally build in a progression which takes them from awareness, through understanding to action

Practise what you preach:
Make sure that the way you run your operation is compatible with the messages you are trying to put across

Offer access
Offer a range of opportunities that will engage different audiences

Look for support
Don't think you have to do it alone; build local networks, share ideas

Evaluate outcomes:
Consider how you will measure the success of your programmes against your intended outcomes

McLeish, 1997

Working in collaboration, ethnobotanists at the IB-UNAM Botanic Garden, Mexico, share their technical and botanical expertise while healers share their knowledge on the traditional and ritual use of plants. This type of partnership has enabled the botanic garden to make this knowledge available to other healers, housewives, professionals and alternative health practitioners in Mexico. Photo: Edelmira Linares, IB-UNAM Botanic Garden, Mexico

A craft school in Archangel, Russia, helps children reconnect with their own culture and the natural environment. Aged between 8 and 18, they come to classes after school, two or three times a week; it takes them three years to become a 'master' at their chosen craft. Once a 'master' they are encouraged to become a teacher themselves and share their skills with other children. The crafts, including basket weaving and wood carving, use local natural materials which the children harvest themselves.
Photo: Sarah Kneebone, BGCI

Sustainability – agreeing on the definition

For consistency in communication to the public, it is important that all staff work to the same definition of sustainability. Before a garden develops an ESD strategy, it is recommended that staff decide on their definition of sustainability. One way of doing this is through staff consultation - a nominated member of staff should coordinate a process whereby staff can express their opinions about sustainability. This might involve staff members meeting to discuss the meaning of sustainability and arriving with a consensus view or it may involve preparing a discussion paper with several definitions for staff to agree on. As a garden's work in sustainability evolves so will its definition. Gardens need to build in a mechanism by which staff can reflect critically on their meaning of sustainability and monitor the viability of their definition.

Botanic gardens are now including sustainability in their mission statements e.g.
Mission of the Eden Project, UK, is to:
'Promote the understanding and responsible management of the vital relationship between plants, people and resources, leading towards a sustainable future for all.'

Foundations of ESD

Research suggests there are four environmental education foundations for learning about biodiversity: the emotional foundation, the ecological foundation, the ethical foundation and the political foundation. As ESD is closely aligned to environmental education, this research can be considered highly relevant to the development of ESD programmes in botanic gardens. Although gardens will place different emphases on the different aspects of ESD, depending on their site, the learners, the educators or their available resources, all four foundations will need to be incorporated in their programmes for the education offered to be called ESD.

Four environmental education foundations for learning about biodiversity
- Emotional foundation: (re)connecting with nature through discovery and sensitisation, and experiencing biodiversity to create personal meaning.
- Ecological foundation: understanding relationships, functions and (global) interdependencies.
- Ethical foundation: dealing with values, taking a moral position, raising critical questions.
- Political foundation; dealing with controversial issues, making choices, developing action competence.

(Wals, 1999, p61)

Learning goals

The foundations above offer a framework within which to establish learning goals and concrete learning objectives. While it is very important to establish these goals, it is vital to remember that the learners themselves play a major part in determining what is actually learned. This is affected by their motivation, past knowledge, skills, attitudes, ideas, expectations, and so forth. Also impacting on a learning experience will be the quality of the garden educators, their support team and the resources available (both financial and physical) as well as external factors such as national curricula and government policy, for example.

The learning goals below are divided into knowledge, skills and ethics and values. Gardens should discuss what knowledge, skills and ethics they want to engender in the groups they work with. The following list, not in order of priority, is intended to help gardens with this discussion.

Knowledge
It is important for individuals to understand the fundamental issues which inform the sustainability debate, namely that:

- The Earth has finite resources.
- The role of the Earth's elements in supporting ecosystems and organisms.
- The nature of ecosystems and biomes.
- When a certain species becomes extinct, a part of the ecosystem also vanishes.
- The importance of plants for sustaining all life on Earth.
- The dependence of humans on plants and the environment.
- The impact of humans on plants and the environment and the consequences of the choices we make, for example with production, consumption, transportation, heating and cooling.
- There is no objective way to achieve sustainability
- The role of science and technology in the development of societies.
- The process of urbanisation and de-ruralisation.
- Whether and how politics, economics, the environment and social issues interconnect.
- The process of resource distribution and use in determining the nature of societies.
- The role of botanic gardens in implementing national strategies and international conventions for biodiversity conservation.
- Processes of planning, policy-making and action for sustainability by governments, businesses, non-governmental organisations and the general public.

Skills
Based on an understanding of the fundamental questions of sustainability, it is important for individuals to develop appropriate skills to:

- Work with different tools (e.g. gardening equipment, magnifying glasses, microscopes).
- Work with plants (e.g. planting, tending, propagating, harvesting).
- Seek out information from a variety of sources.

Children mounting herbarium specimens as part of the Encounters with Naturalists project. This project enabled students in Australia and France to re-enact the scientific collecting work of the first French and English expeditions to South Australia. Students followed in the footsteps of the first European naturalists through plant hunting, seed collection, botanical illustration and mounting herbarium specimens. By having a 'real' context for their work and working alongside contemporary botanists and artists students were able to more meaningfully explore their local plant biodiversity and its conservation. The joint project was between the Botanic Gardens of Adelaide, Australia and the Botanique de la Villa Thuret Botanic Gardens, France. Photo: Botanic Gardens of Adelaide, Australia

- Frame appropriate questions to guide relevant study and research.
- Define fundamental concepts e.g. environment.
- Assess the nature of bias and evaluate different points of view.
- Develop hypotheses based on balanced information, critical analysis and careful synthesis and test them against new information and personal experience and beliefs.
- Communicate information and view points effectively.
- Work towards negotiated consensus and co-operative resolution of conflict.
- Envision sustainable futures and develop strategies for implementing them.

Ethics and Values
An ethical perspective creates a context in which knowledge and skill acquisition may be located to gain:

- An appreciation of the resilience, fragility and beauty of plants and the interdependence of all life forms.
- An awareness of the dependence of human life on plants and other finite resources.
- An appreciation of the role of human ingenuity and individual creativity in ensuring survival and the search for appropriate and sustainable progress.
- An appreciation of the power of human beings to modify the environment.
- A sense of self-worth and belonging in one's own culture and community.
- A respect for those elements of other cultures that contribute to sustainability and a recognition of the interdependence of the human community.
- A concern for inequalities and injustices, a commitment to human rights and social justice and to the peaceful resolution of conflict.
- A personal acceptance of a sustainable lifestyle and a commitment to participation in change.
- A sense of hope and a positive personal and social perspective on the future.

Adapted from Fien et al, 1996

The above list is not rigid. Knowledge, skills and ethics continuously change and staff in botanic gardens need to constantly reassess what it is that they want their visitors and students to learn, taking into account new factors, events and issues affecting the sustainable development debate.

Educational approaches

There is no single way to teach ESD. Taking into account the foundations of ESD and the learning goals, a number of different educational approaches can be used. Specifically they would include:

Experiential and cooperative learning
Many botanic gardens already use this approach in their education programmes. Activities are designed for learners to engage actively in sensory, cooperative and empathetic learning about the environment. The aim of this approach is to instil a sense of wonder and appreciation for the natural world.
In particular this approach:

- Helps learners re-connect with the environment.
- Increases learner motivation. Learners are encouraged to set their own hypotheses and find answers for themselves.
- Encourages learners to make connections between and within disciplines through constructing their own reality (an important component of ESD).
- Develops communication skills – learners work in small groups discussing, negotiating, listening and formulating arguments.

'The School in the Forest' programme at the Gurukula Botanical Sanctuary, India, works with schools, individuals and non-governmental organisations at local, regional, national and international levels. The programme aims to bring about a shift in attitude and alliance within human society with respect to the natural world. Children are exposed to nature and natural history through forest exploration, enquiry, community life, solitude and reflection. Encouraging participants in the programme to use their bodies and senses to experience their visit is a central tenet of the programme. Photo: Suprabha Seshan, GBS, India

Youngsters (aged 8-11) are constructing bird boxes during one of the Green Workshops held at the Conservatory and Botanic Garden of the City of Geneva, Switzerland. The workshops are intended to encourage young people to discover the world of biodiversity. They cover a wide range of topics, including: how to make a herbarium, how to prepare a shelter for insects, cooking with plants that smell good and growing endangered plants. The workshops are delivered by garden professionals and members of the University for the Third Age (UNI3) who like to share their knowledge and joy of living with young people. Photo: Conservatory and Botanic Garden of the City of Geneva, Switzerland.

Examples of activities include, sensory trails, bark rubbing, pond dipping, discovery carts, etc. Earth Education is also an approach that involves experiential learning. The Institute for Earth Education designs and develops educational programmes that focus primarily on understanding basic ecological systems. Programmes look at what these systems mean for people in their own lives and what people must do to begin living more lightly on the Earth (van Matre, 1990).

Role play

Role play involves inviting learners to act out a scenario containing two or more different viewpoints. Role play is a powerful educational tool and can be used to develop skills, enrich emotional awareness (attitudes) and improve understanding of particular situations (knowledge). Learners hold on to beliefs until they are challenged, either by others, by the situations they confront or their own critical attitude. When learners are encouraged to take the position of someone else who is critical of their beliefs they are able to examine them. Once challenged learners either, discard these beliefs and take on new ones, alter them and combine them with new elements or keep them because they withstand the challenge. With the support of a moderator and peers, role play provides a relatively safe space for learners to rehearse their negotiation and decision making skills.

Pointers for successful role play:

- Be clear about what you want learners to get out of the role playing experience.
- Role playing briefs should contain enough information for both parties to engage in a believable and relevant scenario. Give as much detail as is necessary - too little and there won't be enough to sustain a conversation, too much and learners will be swamped with information.
- Make sure there is adequate preparation time. Learners can be encouraged to share what they are trying to achieve with observers, so it becomes a shared, facilitative exercise rather than a 'performance' - this will also defuse fear and tension.
- Offer learners the option to pause when they feel they are getting into difficulty.
- Allow other learners to observe the role play and give their comments afterwards. Observers can be very beneficial to learning.
- For the observers, explain clearly what you want them to look out for. Role play feedback should not contain subjective judgements or comments based on personal knowledge or assumptions. Feedback should be meaningful and specific - something that the learner can act on.

Gardens could develop role play scenarios to examine a range of sustainable issues, such as food sustainability, habitat loss and plant trade. For example a scene could be set up to examine the unsustainable collection of medicinal plants, with background information provided on the potentially conflicting roles of plant collectors, market sellers, business people and a pharmaceutical company.

Participatory action research

This approach aims to improve social situations through a spiral of planning, researching, action and reflection (Ellion, 1991. Any theories or hypotheses developed are validated through practice, rather than being validated independently and then applied to practice. This approach encourages:

- Motivation - participants are keen to find solutions to particular issues.
- Critical thinking - participants are encouraged to discover and critically evaluate a broad range of information.

Kirstenbosch National Botanical Garden, South Africa inspires and enables people from all walks of life to take responsibility for their environment. The garden has received funding from the government's Department of Environmental Affairs and Tourism as part of the Greening of the Nation project to 'green' schools and communities on the Cape Flats. The project includes horticultural training and the development of skills such as critical thinking, problem solving and interpersonal skills. Photos: Donovan Fullard, SANBI, South Africa

Chicago Botanic Garden, USA, has a long tradition of supporting community and school gardens. The Green Youth Farm programme serves African American and Latino communities that have low income rates and significant high school drop out rates. By providing hands on experiences in urban horticulture, the programme has created a new awareness among students about the use of physical space and activity within their community as well as the possibilities for personal achievement. In turn the Green Youth Farm students have energized and inspired adults and institutions and captivated the imagination of media, politicians and philanthropists. Photo: Chicago Botanic Garden, USA

- Collaboration - participants should work together to resolve a situation.
- Communication skills -- listening, discussing and negotiating.
- Effective decision making - reviewing the consequences of their actions enables participants to make better decisions about a particular course of action.
- Resourcefulness – participants need to think laterally to search out information.

The basic cycle of activities in participatory action research involves:

- *identifying a general idea* – that is, identifying a situation to be resolved or improved.
- *reconnaissance* – describing the facts of the situation, explaining the reasons for them, critically analysing them and generating a hypothesis.
- *general planning* – a statement of the situation; a list of factors one hopes to change or modify to improve the situation; a statement of negotiations to be conducted before undertaking the proposed course of action; a list of resources needed; a description of an ethical framework which has been discussed and agreed with the relevant persons.
- *developing the first action step* – a decision should be taken on how the process of implementation and its effects are going to be monitored.
- *implementing the first action step.*
- *monitoring and evaluating the action step* – there are many techniques and methods that can be used to monitor action research, e.g. diaries, document analysis, photographs, tape and video recordings, using an outside observer to work-shadow and carry out interviews, questionnaires, etc.
- *revising the general idea.*

From this basic cycle participants in the action research then spiral into developing the second action step, implementation, evaluation, revising the general idea, developing the third action step, implementation, evaluation and so on. Action research is an ideal approach for those gardens working with local communities to resolve real-life situations such as the over-harvesting of wild plants or the lack of fuel wood for cooking.

Values clarification
This approach encourages learners to clarify their views on particular issues. Firstly by expressing them, secondly by discussing them with people who hold different views and thirdly by re-evaluating them. This approach encourages:

- Critical thinking – weighing up different information
- Motivation – learners are keen to learn about the different views that are held
- Communication – learners articulate their view points and are called on to clarify points

Incorporating values clarification into an activity

The following format can be used to encourage visitors to clarify their values on a particular issue.

- Positioning two sheets of paper at opposite ends of the workshop space. Each sheet could have marked on it a statement that illustrates an opposing view of an environmental or development issue, e.g. Selected harvesting of wild plants versus absolute conservation.
- Participants are then asked to position themselves along a continuum between the two sheets of paper according to their view on the issue.
- Participants discuss the reasons why they have positioned themselves in such a way.
- Participants at opposite ends of the continuum are asked to justify their choices.
- Participants are given an opportunity to reposition themselves based on the discussion.

Gardens could use this approach with visiting school groups and adapt it for the visiting public. An interpretative sign for example could include questions in the text that ask visitors to position themselves according to their views about a particular subject. Information could then be provided, either on the sign or in the form of leaflets, offering differing views. Gardens could also hold seminars where they invite people to speak on differing sides of an issue.

Self-directed learning.
In this approach the educator is seen as a resource person, rather than a font of knowledge. The educator works collaboratively with the learners, encouraging them to make connections between and within disciplines and enabling them to develop meaningful projects. This type of approach is particularly effective when the garden has an on-going relationship with the learners; for example school children carrying out projects. In particular it encourages:

- Independence – participants are responsible for their own learning.
- Research skills – participants are encouraged to find out and evaluate information from a wide number of sources.
- Critical thinking - participants need to weigh up information and made decisions.
- Holistic thinking - participants make their own connections between and within disciplines.

Futures education

This approach involves working with learners to envisage a sustainable future by exploring their expectations and aspirations. While all education is for the future, very little time is spent studying it. Looking at, for example: Where are we going? Where do we want to go? What are our hopes and dreams for the future? What can we do now to help create a more sustainable future? Futures education is a powerful tool for:

- increasing learner motivation - images of desirable goals can affect behaviour in the present.
- encouraging critical thinking - weighing up information and identifying trends.
- clarifying values - identifying values to make informed choices.
- effective decision making - looking at the consequences of one's action on others leads to more thoughtful decision making.
- encouraging creative imagination – through designing alternative futures.

Green Fingers and Healing Hands is a promenade performance held at the University of Oxford Botanic Garden, UK. Aimed at primary schools and family groups, the performance explores the need to conserve plants and use them sustainably. Actors take on the role of the garden's first curator, Jacob Bobart (1642), and a 21st century scientist. During the performance the characters meet and exchange notes on how plants are used in our lives. Photo: Louise Allen, University of Oxford Botanic Garden, UK

Gardens could use this approach to run 'future' sessions with the visiting public and then as a follow up produce an exhibition on preferable futures. A future's trail could also be developed which would engage visitors in finding out about the potential future use of crop plants.

Using themes to communicate messages

Gardens can also raise awareness about sustainability through interpretation using a range of media including signs, displays, talks, drama, brochures and electronic media. Working within a theme is a useful way to ensure that visitors are provided with a meaningful context and specific information. A theme can help provide focus and purpose, making it easier for people to understand what a garden is trying to communicate.

Exploring alternative futures

A useful initial framework for exploring alternative futures is the distinction between probable and preferable futures. An activity focused on plants might take on the following format:

- Learners work in pairs to draw two timelines – one probable and one preferable. They mark on the probable timelines what they *expect* to happen with for example, food crops within the next hundred years and mark on their preferable timeline the events and trends they *would like* to see happen with food crops within the next hundred years.
- Completed timelines can be displayed and the whole group given an opportunity to study them, learners could also report back on their probable and preferable futures.
- A whole group discussion could then focus on questions such as:
  - What are the main similarities/differences on probable and preferable futures?
  - What are the differences between the two?
  - What action is needed to bring about their preferable futures?
  - What organisations are already working towards such futures?

(adapted from Hicks, 1994)

Writing a theme

1 **Select your general topic** (e.g. botany, ethnobotany, biodiversity, fair trade, medicinal plants). Complete the following sentence: 'Generally my education programme is about'

ETHNOBOTANY

2 **State your learning goal**. Complete the following sentence 'Specifically I want my audience to'

GAIN AN APPRECIATION OF THE DEPENDENCE OF HUMAN LIFE ON PLANTS AND RESOURCES OF A FINITE PLANET

3 **Express your theme**. Complete the following sentence 'At the end of my education programme I want my audience to understand that':

RAINFOREST PLANTS HAVE THE POTENTIAL TO CURE MODERN ILLNESSES

(Adapted from Ham, 1992)

Interesting, concise text, relevant images help create clear messages on interpretation panels. Panels are a useful way of communicating the need for sustainability to garden visitors. This example, from the Royal Botanic Gardens, Kew, uses several layers of information to reach different audiences. Photo: Sarah Kneebone, BGCI

Plants touch almost all areas of our lives and so the number of themes a garden could choose from is infinite. The following themes are offered as ideas for gardens developing ESD programmes:

- **Topic: Water**,
Learning goal: Understand the role of water in supporting ecosystems and organisms,
Theme: Home gardens can be carefully planted so as not to rely on water.

- **Topic: Ethnobotany.**
Learning goal: Realise the importance of plants in creating sustainable lifestyles and the need to participate in change.
Theme: Daily choices involving plants can contribute towards sustainable living.

- **Topic: Biodiversity.**
Learning goal: Appreciate the nature of ecosystems and biomes.
Theme: Biodiversity encompasses all species of plants, animals and micro organisms and the ecosystems and ecological processes of which they are part.

- **Topic: Fair trade.**
Learning goal: Appreciate the dependence of human life on plants and resources of a finite planet and develop a concern for inequalities and injustices between humans. *Theme:* The choices we make while shopping have far reaching consequences.

- **Topic: Tourism.**
Learning goal: Gain an appreciation of the power of human beings to modify the environment.
Theme: Carrying seeds and other plant material from one country to another may put the environment at risk.

- **Topic: Habitats.**
Learning goal: Understand the nature of ecosystems and biomes.
Theme: Native animals rely on our backyards as habitats.

- **Topic: Edible plants.**
Learning goal: Appreciate the power of human beings to modify the environment.
Theme: Tins of tomatoes don't grow on trees!

Educational resources

Many gardens produce educational resources to complement their education programmes. These include teaching packs, information sheets, videos, computer games, web sites etc. When developing resources for ESD programmes though, gardens need to ensure that from content through to production, they reflect the principles of sustainability. If not, the garden's message is in danger of being contradictory and lacking in coherence.

The following ten principles provide a framework for gardens developing resources for ESD programmes. Not all principles however will be applicable to all resources, and gardens should be flexible in their approach. The intention of the principles is to focus gardens on matters relevant to sustainability in terms of both the production process and content.

Ten Principles of Good Practice

Content

Principle 1: Principles of sustainable development
- Resources should foster understanding of the principles of sustainable development and the aims and significance of Agenda 21

Principle 2: Integrity
- Information and data provided should be accurate, current and verifiable

Principle 3: Balance
- Resources should accurately reflect the broad range of informed opinion on the subject.

Principle 4: Values and attitudes
- Resources should help people to explore values and develop responsible attitudes in relation to their fellow citizens and the environment, from local to global level.

Principle 5: Knowledge and skills
- In addressing environmental and development issues, resources should help develop the knowledge, skills and competencies to enable people to participate effectively in their resolution

Principle 6: User-centred approach
- Resources should be easy to use and appropriate for the intended audience

Process

Principle 7: Need
- Producers should be able to demonstrate an identified need for the proposed resource

Principle 8: Development
- Producers should ensure that the development of the resource is inclusive, participative and has drawn on appropriate educational expertise

Principle 9: Production
- Producers should demonstrate that the production process has followed best sustainable practice wherever possible

Principle 10: Promotion and distribution
- Producers should consider the implications of promotion and distribution from the outset and ensure that they are effective, appropriate and accessible.

Council for Environmental Education, 1999.

Gardens also buy or borrow resources as well as producing them. These principles can be used to help ensure that the resources selected have been developed and produced in ways that follow sustainable principles.

Evaluation

By employing a range of evaluation techniques, educators may reflect on and develop a greater understanding of their current practices. Evaluation is either summative or formative. Summative evaluation is designed to report on – or sum up – the achievements at the end of a process or programme whereas formative evaluation is used to judge and comment on a process or programme while it is in progress, helping to form its future shape. To ensure that evaluation is relevant and effective gardens need to determine its purpose and implementation. What is the aim of evaluation? What should be evaluated? Who should be doing the evaluation and for whom? Will participants of programmes, for example, be involved in deciding on evaluation criteria?

There are a number of evaluation techniques and methods a botanic garden could use. These include:

- *Questionnaires* – using open and closed questions.
- *Diaries* - containing observations, interpretations, reflections, hypotheses, explanations, anecdotes, conversations, etc. as well as facts.
- *Interviews* – structured (pre-set questions), semi-structured (pre-set questions but allowing interviewee to digress and raise their own topics) or unstructured (initiative for raising the relevant topics and issues is left to the interviewee). Interviews may be conducted by educators, but, to ensure impartiality, it is better to use someone outside the garden.
- *Outside observer* – this person needs to be well briefed in order to collect and document the relevant sort of information.
- *Photographs* – these can capture the visual aspects of a programme, for example, how learners are involved in a programme, the layout of the workshop, the pattern of social organisation (eg. whether students are working in groups or individually). Photographs are best taken by an outside person.
- *Tape/video recordings* - these forms of evaluation can be distracting, although tapes less so. However if used regularly students become accustomed to them and cease to take any notice. Transcribing of tapes is very useful, albeit immensely time consuming.

> ***"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."***
>
> *(Fritjof Capra, 1996)*

Belo Horizonte Zoo and Botanic Foundation, Brazil, considers its role in education as extremely important in forming individuals who recognize themselves as an important piece of the global ecological jigsaw. The Foundation interacts with its visitors in different ways, for example signage, educational activities, plays, talks and exhibitions. Here, young children are expressing themselves through art, visually representing what they have learnt during their visit. Photo: Belo Horizonte Zoo and Botanic Garden Foundation, Brazil

- *Artwork* – children and adults can be asked to illustrate their thoughts and feelings about the education programme or a particular subject through drawings, paintings and sculptures.
- *Quizzes* – evaluation can be made into a game with children participating in quizzes.

Evaluation is an integral part of any education programme and critical to the success of ESD. The task of evaluation must be included in the job description of all educators and a budget set aside to enable them to gather information and process it. By doing so, educators will markedly improve the quality of their current practices.

The botanic garden as a model for sustainability

A botanic garden education programme cannot operate in isolation from the rest of the garden. It is an integral part of the garden's operations. For a garden therefore to participate in building a sustainable society it must commit not only its education programme but also the rest of its operations. No matter where in the garden a sustainability model emerges from - education, horticultural or administration - its first purpose must be to engage the support of the rest of the garden. It is only then that it will be able to present a unified and coherent model of sustainability to the greater community.

A first step therefore may be to build sustainability into the garden's institutional policies (see 2.18.4 Sustainable practices within the botanic garden, International Agenda for Botanic Gardens in Conservation, op cit.). To persuade the rest of the garden staff to share in a vision of sustainability, good information should be provided in a range of different ways. This could take the form of information sheets, seminars, newsletters etc. Experiential workshops could also be run so that staff can explore their feelings and issues to do with sustainability, understand the benefits and contribute new ideas and solutions to building a sustainable garden.

Conducting a green audit

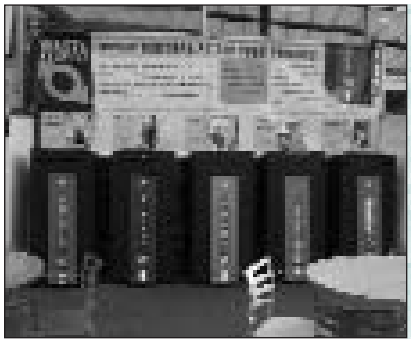
Once staff are committed to a vision a botanic garden may begin to consider how its operations can reflect the ethics of sustainability. An effective way to do this is to conduct a green audit, which entails looking critically at all areas of a garden's operations in relation to sustainability. While all members of staff will be involved in some way, it is important for a designated person to be responsible for overseeing the audit

The National Botanic Garden of Cuba believes that its award winning eco-restaurant will provide a nutritional model for the future. All food served in the restaurant is produced in the garden and menus incorporate both cultivated and wild plants, thereby educating people about alternative plant species. Waste is composted and returned to the garden, again providing a model of sustainability. Photo: National Botanic Gardens, Cuba

Caring for the Earth: A Strategy for Sustainable Living (IUCN, UNEP and WWF, 1991) proposes nine principles for a sustainable society:

- *Respect and care for the community of life.*
- *Improve the quality of life.*
- *Conserve the Earth's vitality and diversity.*
- *Minimize the depletion of non-renewable resources.*
- *Keep within the Earth's carrying capacity.*
- *Change personal attitudes and practices.*
- *Enable communities to care for their own environments.*
- *Provide a national framework for integrating development and conservation.*
- *Create a global alliance.*

The aim of these principles is for them to be translated into action. Here they are used as a framework within which to conduct a green audit. The following questions are merely suggestions, not exhaustive and gardens can adapt them to their own situation. They are intended to focus gardens on areas in which they may need to pay more attention.



Recycling at the Eden Product, UK, is big and brash. Eden is working to ensure that all its potential waste is made from materials that can be recycled and that it uses and sells items made from recycled materials. When the weight of materials sent for recycling equates to the weight of products on site made from recycled materials Eden will be ....Waste Neutral. Photo: Catherine Cuttler, Eden Project, UK

Respect and care for the community of life.
Does the garden:

- Carry out environmental impact assessments when any part of the garden is significantly altered?
- Accept sponsorship from companies and other donors that have an adverse effect on the environment?
- Play a role in influencing the agendas of those companies and other donors towards the environment?
- Engage in wider programmes outside the botanic garden which supports this principle?

Improve the quality of life
Does the garden:

- Improve staff job satisfaction?
- Support staff to realise their potential?
- Allocate time and resources for staff training and development?
- Conduct outreach programmes focusing on health and/or food security?
- Employ local people?

Conserve the Earth's vitality and diversity
Does the garden:

- Have a plant conservation strategy? Has it registered its participation in the International Agenda for Botanic Gardens in Conservation?
- Comply with relevant environmental legislation?
- Dispose of food waste in a sustainable way?
- Set achievable targets for reducing water consumption?
- Recycle water and/or collect rainwater?
- Know the source of each waste type it produces and volume?
- Set targets to minimise waste?
- Ensures that all waste is treated according to environmental legislation or regulations?
- Use products that are or can be recycled both outdoors in the garden and in its administration?
- Provide recycling stations for the public?
- Recycle the following:
  - water
  - green garden waste
  - glass
  - plastic
  - drink cans
  - food cans
  - office paper
  - cardboard
  - newspapers and magazines
  - batteries
  - toner cartridges
  - machine oil
  - other?
- Purchase environmentally friendly cleaning products?
- Purchase in bulk to minimise packaging waste?

Minimize the depletion of non-renewable resources
Does the garden:

- Set realistic targets for reducing energy consumption.
- Provide staff training in the importance of minimising the depletion of non-renewable resources?
- Ensure that glasshouses are designed to minimise heat loss?
- Use renewable energy (e.g. solar panels, wind turbines)?
- Take measures to build energy efficiency into new building projects?
- Provide secure areas for bicycles for staff and visitors?
- Encourage staff to travel to meetings outside work using public transport?
- Encourage visitors to visit the garden by public transport, foot or bicycle?

Keep within the Earth's carrying capacity
Does the garden:

- Work with its national government to implement the Convention on Biological Diversity?
- Work with the relevant authorities to monitor CITES?
- Provide information to the public about the problems of plant over-collecting and increase their understanding of the complexity of the problem?
- Raise the public's awareness about the Convention on Biological Diversity and other environmental policies?

Over consumption is probably one of the greatest problems facing the environment.
Does the garden:

- Carry out environmental audits and set targets for reducing consumption?
- Ensure that the products sold in the shop and restaurant or café are derived from ethically produced sources, have come from renewable sources and/or are recyclable (i.e. Does the garden have an environmentally sensitive purchasing policy)?
- Ensure that their tea shops and restaurants have reusable rather than throw away crockery and cutlery?
- Ensure that the food served reflects healthy living, is seasonal, locally produced and organic?

Change personal attitudes and practices
Does the garden:

- Model the ethics of living sustainably?
- Promote equal opportunities within the garden?

Cheyenne Botanic Gardens, USA, generates approximately 40 to 50% of its electricity from a photovoltaic solar energy system, powering paddle fans, irrigation controls, many lights and all of the computers and office equipment. The Gardens have pioneered many techniques in solar greenhouse gardening and the use of integrated pest management. Photo: Shane Smith, Cheyenne Botanic Gardens, USA

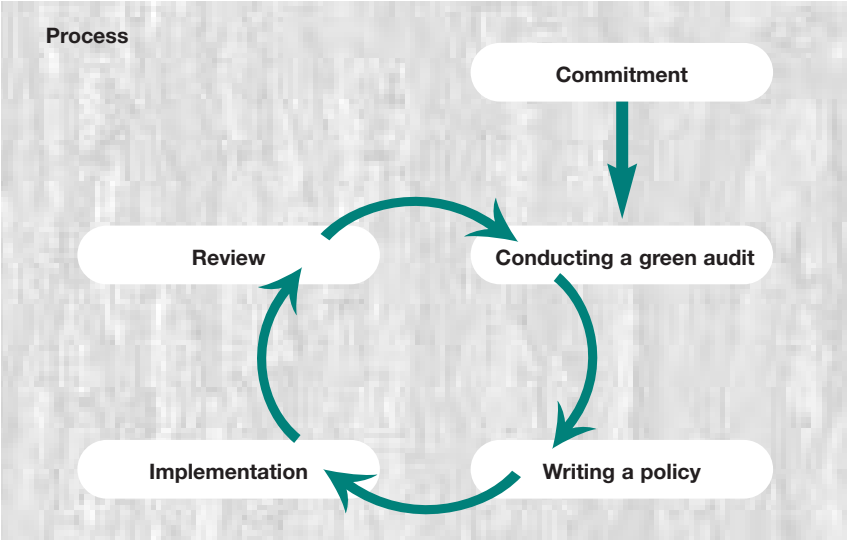
- Run education for sustainable development programmes?
- Disseminate information through formal and informal education systems about sustainability?
- Promote sustainable tourism?

Enable communities to care for their own environments
Does the garden:

- Provide information to communities about plants including how to cultivate and harvest them?
- Provide resources (e.g. expertise, time, plants, compost) for communities to care for their own environment?
- Help communities to respect, value and care for their communities?
- Encourage urban regeneration programmes?
- Run training programmes on sustainable farming and harvesting?
- Train communities in the cultivation, harvesting and use of medicinal plants?
- Work with local people to document their knowledge about plants and their uses?

"When we try to pick out anything by itself, we find it hitched to everything else in the Universe."

(John Muir, 1911)



Provide a national framework for integrating development and conservation
Does the garden:

- Work with its government to implement national plans for sustainability and biodiversity conservation?
- Provide up-to-date scientific information to relevant bodies in order that the environment is internalised in economic decisions?

Create a global alliance
Does the garden:

- Belong to BGCI and participate in the international community of botanic gardens?
- Belong to other conservation organisations/networks – national and regional?
- Support the development of other botanic gardens?
- Provide resources for staff to visit other botanic gardens and institutions to learn about best practice in sustainability?
- Ensure internet access for staff?

Having conducted a green audit, the next step for botanic gardens is to write a sustainability policy capable of review and updating. In addition to staff having specific responsibilities for implementing sustainable practices, the garden should designate staff to oversee its sustainability policies. Once the policy is written the garden may choose to open itself up for external review and invite comments from visitors and/or other institutions.

Delegates at the 2nd World Botanic Gardens Congress in Barcelona, Spain. 500 delegates from over 70 countries agreed to adopt international targets for plant conservation, including a commitment to help conserve 75% of the world's critically endangered plant species by 2010. Photo: BGCI

Partnerships

Botanic gardens alone cannot achieve sustainable development. It is important that they work with a wide range of organisations – local, national, regional and international - to develop and implement collaborative programmes for ESD. Gardens operate on limited budgets and by working with partners can maximise their effectiveness. Potential partners would include:

- other botanic gardens
- community groups (eg. conservation NGOs, ecology clubs, garden clubs)
- teacher training institutions
- local and national government
- national parks and other protected areas such as nature reserves
- campaigning organisations
- museums, zoos and art galleries
- schools
- church groups
- farmers
- businesses such as tourism operators
- other representative bodies

Through working with such groups, botanic gardens are more likely to reach wider audiences and bring to their programmes different skills, knowledge and resources that will benefit them and the participants. The word partnership implies an equality of commitment and involvement. Gardens should therefore participate actively and fully in all stages of the process: assessment, planning, implementation and evaluation.

Partners from European botanic gardens meet in Innsbruck, Austria to discuss the 'Plascikids' project. 'Plascikids' is led by Innsbruck Botanic Gardens and partnered by staff in Sofia Botanic Garden, Bulgaria, Trento Botanic Garden, Italy, Institute of Education, UK and Royal Botanic Gardens, Kew, UK. The aim of the project is to develop primary level, plant science focused activities, support materials and on-line resources in four languages. Funded by a grant from the European Union, the resources will be developed in association with four schools in each country and will be used use by educationalists in botanic gardens and visiting teachers. Partners include, from left to right: Johanna Mihevc (Austria), Constantino Bonomi (Italy), Vera Grancharova (Bulgaria), Krassimir Kossev (Bulgaria), Suzanne Kapalari (Austria), Sue Johnson (UK), Gail Bromley (UK), Harald Geir (Austria). Photo: Gail Bromley, Kew, UK

Conclusion

'Native Tree-Root of Life' is the name of a project run by Kadoorie Farm and Botanic Garden, Hong Kong. With the aim of restoring Hong Kong's forest ecosystem, the project helps students discover the ecological and cultural link between native trees and themselves. Through the learning process, secondary students can gain inspiration from and re-connect with the natural world. Photo: Kadoorie Farm and Botanic Garden, Hong Kong.

Creating a scenario and inviting participants to step into the minds of the people concerned is the essence of Botanica, a simulation game created by SEED (Support for Education in Environment and Development) the education arm of the Leicester University Botanic Garden, UK. Botanica provides a forum where participants are forced to consider issues from different perspectives, which may differ radically from their own, but it also enables them to practise, use and sometimes aquire the skills necessary for tackling similar issues in real life. In the scene here, students are playing the part of plantation workers spraying toxic chemicals. The plantation manager is the only one who wears protective clothing.

Education for Sustainable Development is an holistic model capable of addressing the environmental questions of the 21st century. Botanic gardens are uniquely placed to develop ESD programmes with their local communities. By demonstrating how plants are relevant to almost every aspect of our lives they are also well placed to explore the complex interdependence of plants and humans. These guidelines outline a variety of approaches in ESD that are intended to support botanic gardens in their work.

Botanic gardens traditionally inform and educate their visitors on the importance of plants in our everyday lives. While this is valuable it is not sufficient for the purposes of sustainability. 'As the issues that surround us are fundamentally systemic, we need to think in an integrative way and act accordingly' (Sterling, 2001). Botanic gardens have a responsibility to engage in a more rigorous form of ESD; challenging their public to clarify their own positions on sustainability and work towards finding viable solutions. Botanic gardens are likely, by reason of culture and geography, to have their own distinct perspectives on their environment and this is likely to be reflected in their approach to ESD (Fien & Tilbury, 1998). Their very uniqueness is capable of providing exciting and relevant new programmes which may have valuable lessons for the wider community of botanic gardens.

All the major international environmental conventions stress the importance ESD in resolving environmental issues. The adoption by the United Nations of a Decade of Education for Sustainable Development from 2005 to 2015 provides a clear mandate for botanic gardens to contribute to this vitally important mission.

Appendices

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Useful international websites

www.bgci.org/education
This site offers a range of educational resources for plant-based education

www.biodiv.org/programmes/outreach/cepa
Electronic portal to disseminate information, list partner organisations and share case studies and best practices in Communication Education and Public Awareness (CEPA)

www.iucn.org/themes/cec
This site is about how to interest and motivate people for the environment and sustainable development. It includes guidance and tools on how to use communication and education as a policy or management tool.

<http://portal.unesco.org/education/en>
Click on link to access information about the United Nations Decade of Education for Sustainable Development

www.worldbank.org/depweb/
Web site of education for sustainable development materials

http://earthtrends.wri.org/
On-line database that focuses on the environmental, social and economic trends that shape our world. Information is presented in multiple formats.

www.peacechild.org
Site for young people, informing them about major world issues and how they can take action. Link to publications for information on Rescue Mission: Planet Earth - the children's addition of Agenda 21.

Key points on Education for Sustainability from the 4th International Congress on Education in Botanic Gardens *'The Power for Change'*, India 1999

Education for sustainability

- Botanic gardens should become experts in the implementation of the Convention on Biological Diversity and integrate concerns with biodiversity conservation into environmental education programmes to spread the message to the general public.
- Botanic gardens should be developed as resource centres appropriate to their climate, culture and community needs.
- Botanic gardens should base their environmental education programmes on innovative education methods that encourage sensory discovery, emphasise imagination and contemplation, and encourage people to learn through emphasising values and critical questions, inquiry and communication.
- As centres of knowledge and its documentation, botanic gardens should protect intellectual property rights of those who hold knowledge, i.e. rural community.
- Botanic gardens should determine their role in precipitating social change required for achieving environmental sustainability.
- Botanic gardens should know their target audience and use a variety of techniques, settings and approaches (i.e. community gardens festivals, clubs, flower shows, empirical studies) to bring sustainability to the public.
- Botanic gardens should promote the sustainable use of plants for local communities.
- A range of botanic garden staff should be involved with the environmental programmes, thereby providing a diverse range of educational services by using the range of skills and knowledge within the organisation.
- Botanic gardens should carefully evaluate the gardens' use and the impact of their environmental education programmes on participants.
- Botanic gardens have a role in providing support to and building the capacity of, national and regional education departments in the integration of 'environment' across the formal school curriculum to provide opportunities for an issues and outcomes based learning approach which links social, political and economic processes to natural systems.

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