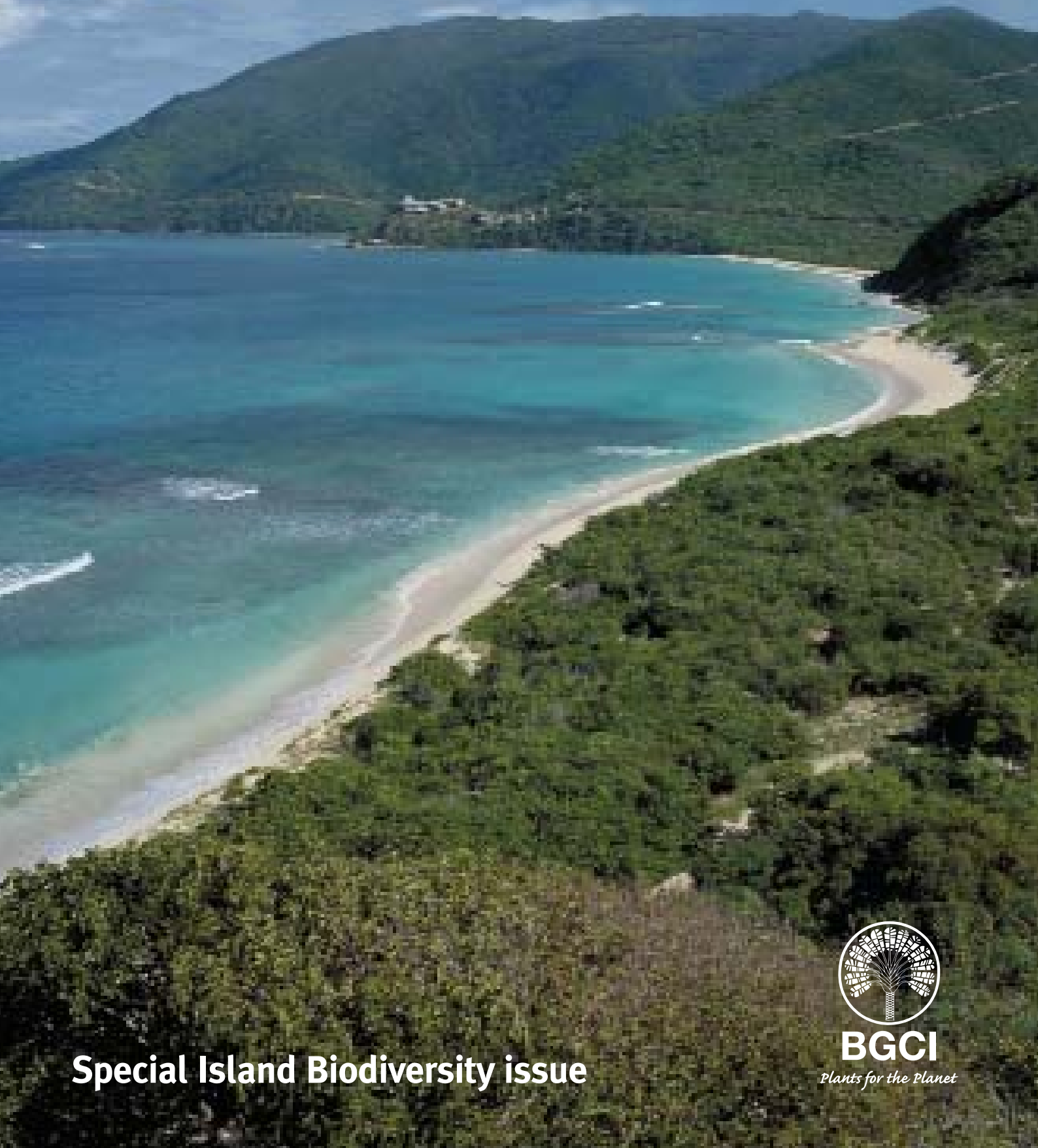


# BGjournal

Journal of Botanic Gardens Conservation International

Volume 2 • Number 1 • January 2005



**Special Island Biodiversity issue**



**BGCI**

*Plants for the Planet*

# Forthcoming Meetings

January 24 – 28, 2005

**PARIS, FRANCE**

Biodiversity: Science and Governance

This international conference is being held under the high patronage of M. Jacques Chirac, President of the French Republic, and Mr Koïchiro Matsuura - Director-general of UNESCO.

For further information contact:

biodiv2005paris@recherche.gouv.fr,

Internet: [www.recherche.gouv.fr/biodiv2005paris](http://www.recherche.gouv.fr/biodiv2005paris)

February 7 – 9, 2005

**LONDON, U.K.**

*Barcode conference - consortium for the barcode of life (CBOL)*

The First International Barcode Conference is being organised by CBOL, an international cooperative effort among natural history museums, herbaria, zoos, government agencies, research organisations and private companies. Researchers, policy-makers, representatives of biotechnology companies and officials from applied science agencies (e.g. public health, agriculture, environment, conservation) are invited to attend.

For details contact

E-mail: [bolbursaries@nhm.ac.uk](mailto:bolbursaries@nhm.ac.uk),

Internet: <http://www.nhm.ac.uk/science/BOL/>

May 8 – 13, 2005

**BRISBANE, AUSTRALIA**

*8th International Workshop on Seeds - Germinating new ideas*

This workshop is being organised by the International Society for Seed Science. For information, contact Allison Bertoni-Remmes or Krys Henshaw, Organisers Australia, PO Box 1237, Milton, QLD 4064, Australia. Tel: +61 7 3371 0333, Fax: +61 7 3371 0555, E-mail: [info@seedbio2005.asn.au](mailto:info@seedbio2005.asn.au), Internet: <http://www.seedbio2005>

June 29 – July 3, 2005

**CHICAGO, U.S.A.**

*American Association of Botanic Gardens and Arboreta (AABGA) 2005 Annual Conference Rooted in Your Community*

The AABGA Conference will be held at the Morton Arboretum, Chicago. For further information, contact Martez Taylor, AABGA Meetings Manager, 100 West 10th Street, Suite 614, Wilmington, DE 19801, U.S.A. Tel: +1 302-655-7100, ext 18, E-mail: [mtaylor@aabga.org](mailto:mtaylor@aabga.org) Internet: <http://aabga.org/>

July 18 – 23, 2005

**VIENNA, AUSTRIA**

*XVII International Botanical Congress (IBC 2005)*

The International Botanical Congress is held every six years and provides a forum for the presentation and discussion of the latest advances in plant sciences worldwide. It follows the IBCXVI which was held in



Denver Botanic Gardens

and

UNITED STATES



BOTANIC GARDEN

present the

## Applied Plant Conservation Training Program

June 2005

- Principles and techniques used in the research and conservation of threatened plants
- One and two week seminars featuring the Center for Plant Conservation
- Eight week research internship

Admission is limited and competitive.

Application deadline is March 1, 2005.

[www.appliedplantconservation.org](http://www.appliedplantconservation.org)

St Louis, Missouri, U.S.A. in August, 1999, which passed a resolution on the need for a *Global Strategy for Plant Conservation* (GSPC). The Second Circular was distributed in the summer of 2004.

For further information contact Prof. Dr Marianne Popp, Institute of Botany, University of Vienna, Rennweg 14, A-1030 Vienna, Austria. Tel: +43-1-4277-54123, Fax: +43-1-4277-9541, E-mail: [Marianne.Popp@univie.ac.at](mailto:Marianne.Popp@univie.ac.at) or [botanik@univie.ac.at](mailto:botanik@univie.ac.at), Internet: <http://www.abc2005.ac.at/>

November 9 – 12, 2005

**OAXACA, MEXICO**

*First DIVERSITAS Open Science Conference (OSC) on Biodiversity Integrating biodiversity science for human well-being*

This conference, DIVERSITAS: OSC1 offers an opportunity to explore recent advances and probe pressing issues across the breadth of biodiversity science. For general enquiries about DIVERSITAS: OSC1, please contact the DIVERSITAS Secretariat, DIVERSITAS, 51, bd Montmorency, 75016 Paris,

France. Tel: + 33 1 45 25 95 25, Fax: + 33 1 42 88 94 31, E-mail: [info@diversitas-osc1.org](mailto:info@diversitas-osc1.org), Internet: <http://www.diversitas-osc1.org/>

June 19 - 25, 2006

**SANTO DOMINGO, DOMINICAN REPUBLIC**

*IX Congress of the Latin American Botanical Society (IX Congreso Latinoamericano de Botánica) Contribuyendo al conocimiento global de la flora nativa latinoamericana (Contributing to the global knowledge of the native flora of Latin America)*

The objectives of this Congress are to spread information about the flora of Latin America and bring together the botanical community to develop plans for the conservation and sustainable use of its flora. For further information, please contact Sonia Lagos-Witte, President, Asociación Latinoamericana de Botánica - ALB and Coordinator, IX Congreso Latinoamericano de Botánica, Jardín Botánico Nacional, Apartado Postal 21-9, Santo Domingo, Dominican Republic. Tel: +1 809 385 2611/2612, Fax: +1 809 385 0446, E-mail: [tramilca@codetel.net.do](mailto:tramilca@codetel.net.do), Internet: <http://www.botanica-alb.org>



**Editors:** Etelka Leadlay and Peter Wyse Jackson

**Cover Photo:** Gorda Peak National Park (GPNP) and Savannah Bay, Virgin Gorda, British Virgin Islands. A conservation checklist for GPNP is well underway and some of the endemics are in cultivation in the J.R. O'Neal Botanic Gardens (see page 10) (Photo: Royal Botanic Gardens, Kew, U.K.).

**Design:** John Morgan, Seascape  
E-mail: [studio@seascape-design.fsnet.co.uk](mailto:studio@seascape-design.fsnet.co.uk)

Submissions for the next issue should reach the editor before 20th April, 2005. We would be very grateful for text on diskette or via e-mail, as well as a hard copy. Please send photographs as original slides or prints unless scanned to a very high resolution (300 pixels/inch and 100mm in width); digital images need to be of a high resolution for printing. If you would like further information, please request *Notes for authors*.

*BGJournal* is published by **Botanic Gardens Conservation International (BGCI)**. It is published four times a year and is sent to all BGCI members. Membership is open to all interested individuals, institutions and organisations that support the aims of BGCI (see page 15 for Membership application form)

Further details available from:

- Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond, Surrey TW9 3BW UK. Tel: +44 (0)20 8332 5953, Fax: +44 (0)20 8332 5956 Email: [info@bgci.org](mailto:info@bgci.org), [www.bgci.org](http://www.bgci.org)
- BGCI-Russia, c/o Main Botanical Gardens, Botanicheskaya st., 4, Moscow 127276, Russia. Tel: +7 (095) 219 6160 / 5377, Fax: +7 (095) 218 0525, E-mail: [seed@aha.ru](mailto:seed@aha.ru), [www.bgci.ru](http://www.bgci.ru)
- BGCI (U.S.) Inc., c/o Dan Shepherd, Director, 1000 Washington Avenue, Brooklyn, New York 11225-1099, U.S.A. Tel: +1 718 623 7200, Fax: +1 718 857 2430, Email: [dan.shepherd@bgci.org](mailto:dan.shepherd@bgci.org), [www.bgci.org/us](http://www.bgci.org/us)
- BGCI-Netherlands, c/o Utrecht University Botanic Gardens, P.O. Box 80162, NL-3508 TD, Netherlands. Tel: +31 30 253 2876, Fax: +31 30 253 5177, E-mail: [l.j.w.vandenwollenberg@bio.uu.nl](mailto:l.j.w.vandenwollenberg@bio.uu.nl), [www.bi.uu.nl/botgard](http://www.bi.uu.nl/botgard)
- BGCI-Canarias, c/o Jardín Botánico Canario Viera y Clavijo, Apartado de Correos 14, Tafiara Alta 35017, Las Palmas de Gran Canaria, Gran Canaria, Spain. Tel: +34 928 21 95 80/82/83, Fax: +34 928 21 95 81, E-mail: [jmlopez@grancanaria.es](mailto:jmlopez@grancanaria.es)
- BGCI - China and South East Asia, c/o Registry, Singapore Botanic Gardens, 1 Cluny Road, Singapore 259569. Email: [Bian.Tan@bgci.org](mailto:Bian.Tan@bgci.org), [Anle.Tieu@bgci.org](mailto:Anle.Tieu@bgci.org), [www.bgci.org/china](http://www.bgci.org/china)
- BGCI-Colombia, c/o Jardín Botánico de Bogotá, Jose Celestino Mutis, Av. No. 61-13 - A.A. 59887, Santa Fe de Bogotá, D.C., Colombia. Tel: +57 630 0949, Fax: +57 630 5075, E-mail: [jardin@gaitana.interred.net.co](mailto:jardin@gaitana.interred.net.co), [www.humboldt.org.co/jardinesdecolombia/html/la\\_red.htm](http://www.humboldt.org.co/jardinesdecolombia/html/la_red.htm)
- BGCI-Deutschland, c/o Botanische Gärten der Universität Bonn, Meckenheimer Allee 171, 53115 Bonn, Germany. Tel: +49 2 2873 9055, Fax: +49 2 28731690, E-mail: [biogart@uni-bonn.de](mailto:biogart@uni-bonn.de)

BGCI is a worldwide membership organization established in 1987. Its mission is to build a global network for plant conservation. BGCI is an independent organization registered in the United Kingdom as a charity (Charity Reg No 1098834) and a company limited by guarantee, No 4673175. BGCI is a tax-exempt (501(c)(3) non-profit organization in the USA and in Russia.

Opinions expressed in this publication do not necessarily reflect the views of the Boards or staff of BGCI or of its members

*BGJournal* replaces *BGCNews* and is published twice a year (Volume one of *BGJournal* only consists of one issue). The news section of *BGCNews* and *Roots* (Botanic Gardens Conservation International Education Review) is now contained in *Cuttings* which is published quarterly. There are 31 issues of *BGCNews* published twice yearly from 1987-2003.

## Contents

### 02 Editorial

### 03 Introduction - The conservation and sustainable use of island biodiversity

### 05 The challenge of the GSPC – how the Seychelles, a small tropical island state, is responding

### 07 Conservation on St. Croix, US Virgin Islands: the role of St. George Village Botanical Garden

### 10 Building capacity and developing botanical infrastructure for conservation: a case study from the British Virgin Islands

### 13 Conservation programmes in New Caledonia, western Pacific

### 14 Plant conservation in Galapagos, Ecuador

### 17 The National Tropical Botanical Garden: creating a Genetic Safety Net for Hawaii's vanishing flora

### 20 Sustaining biodiversity on Captain Corelli's Island – Cephalonia, Ionian Islands, Greece

### 22 Integrated plant conservation on Pitcairn Island, south-central Pacific Ocean

### 25 Micropropagation of Bois papaye, *Badula balfouriana*; a critically endangered plant, endemic to Rodrigues, Mascarene Island, western Indian Ocean

### 27 Short Communications

### 29 Book Notices

### 31 Registration Form for the International Agenda for Botanic Gardens in Conservation

### 32 How to join Botanic Gardens Conservation International

#### Publications List



---

# Editorial

The special importance of botanic gardens for the conservation of island floras has long been recognised. So many island endemic plant species occur as small populations, often with very restricted distributions surviving in much modified wild habitats. This has encouraged botanic gardens to develop and implement ex situ conservation and species recovery programmes for many such threatened species. It has often been straightforward to propagate, cultivate and maintain the complete spectrum of surviving genetic variability, since such species are often reduced to one, two or just a handful of remaining plants. The collections of botanic gardens around the world have therefore become rich in species that are on the very verge of extinction, preserving clones of the last wild specimens in cultivation or storage until restoration in nature becomes possible. Understanding and managing the full range of genetic diversity of threatened but widespread species can be complex, particularly if botanic gardens do not have facilities for molecular studies of diversity. It is clear however that the staff of botanic gardens with limited facilities, as occur in some island countries, can play an increasingly important and effective role in the conservation of their own floras, applying their practical skills to help ensure that some of the rarest plants in the world will survive.

In the mid 1980s, I was closely involved in the conservation of some remarkable but highly endangered species from the island of Mauritius in the Indian Ocean, which sparked my interest in international plant conservation in general. This special issue

of *BGjournal* is therefore of particular personal interest to me. As can be seen from the articles included in this issue, it is very notable that while the ex situ conservation of island plants has been undertaken by botanic gardens for several decades, over the last ten years they have been increasingly involved in the development of integrated recovery programmes. These have addressed not only individual species but also the restoration of damaged and degraded ecosystems and associated public education and awareness issues.

Beginning in the mid 1970s, the IUCN Botanic Gardens Conservation Coordinating Body (the predecessor of BGCI) began to survey threatened plants in botanic garden collections. Particular emphasis was given to surveys of oceanic island plants, many of which were found in the collections of botanic gardens in, for example, Europe and North America. In some instances, these collections have been extremely important to provide the basis for reintroductions, maximising existing gene pools and for planning species recovery.

Such survey work of threatened plants in botanic gardens of course continues through BGCI. The launch of the on-line 'Plant Search' on the BGCI website ([http://www.bgci.org/conservation/plant\\_search.html](http://www.bgci.org/conservation/plant_search.html)) provides a new means for individual botanic gardens not only to assess their collections in comparison with the IUCN Red List of Threatened Plants but also to review how many other botanic gardens are cultivating the same taxa.

Although information on which individual botanic gardens are cultivating which taxa is not provided in the database (security of collections and other access and benefit sharing issues has encouraged BGCI to keep such information confidential), nevertheless an email system has been set up whereby potential collaborators can request information from the holders of particular taxa. We hope that this will encourage and support groups of botanic gardens to work together to develop collaborative projects for particular threatened plants grown by several institutions.

To date, the on-line database includes information on over 100,000 taxa known to be in cultivation in botanic gardens, of which some 10,000 are listed by IUCN as representing threatened species. We encourage more botanic gardens to play a part in the development of this database, that not only will help to document the achievement of the ex situ conservation targets (target 8) of the Global Strategy for Plant Conservation, but also provide a valuable new tool to help in the management and prioritization of individual botanic garden collections. Guidance on how to use the database is also provided on the website (at [http://www.bgci.org/botanic\\_gardens/Instructions.html](http://www.bgci.org/botanic_gardens/Instructions.html)) \* but BGCI staff too will be very pleased to provide assistance and any practical guidance needed.

**Peter Wyse Jackson**  
22nd December 2004

\* Also see *BGjournal* 1(1) 26-28, July 2004.

# Introduction – The conservation and sustainable use of island biodiversity

The common denominators of island ecosystems are their uniqueness, their high level of endemism, and their susceptibility to the effects of natural, technological and human-related hazards and interference. Generally, islands (particularly oceanic islands) present high levels of endemism and a high number of species with small populations, limited large and few refugia, which makes them highly vulnerable to extinction. Indeed, islands present a high proportion of recorded extinctions and of current critically endangered species.

In addition to the fragile nature of island ecosystems, the small size of islands reduces their assimilative and carrying capacity for biodiversity. As land is limited, urban settlement and commercial development (particularly mass tourism), agriculture and forestry practices and conservation are in competition. Islands with limited land areas have limited capacity to either buffer or trade off natural events and cope with a series of interplaying factors. Small islands are subject to cumulative vulnerability to changes in natural events (e.g. earthquakes, volcanic eruptions, cyclones, hurricanes, floods, droughts, hurricanes, and tidal waves). Moreover, low resistance to outside influences can allow the rapid spread of invasive alien species, endangering endemic species of flora and fauna. In general, islands are disproportionately threatened by climate change through sea-level rise and their relatively large coastal



Left: View of the National Botanic Gardens, Mahé, Seychelles. (Photo: Peter Wyse Jackson)

zone, in relation to their land mass, makes small islands prone to erosion.

These major threats to island biodiversity are often undermined further by institutional, technical and capacity-related constraints, inadequate knowledge and policy frameworks.

The need for action for the conservation of island biodiversity was highlighted at the seventh meeting of the Conference of the Parties to the Convention on Biological Diversity (COP7) held in Kuala Lumpur, Malaysia in February 2004. COP7 adopted a multi-year programme of work of the Conference of the Parties up to 2010 and decided to establish a new

thematic programme of work on Island Biodiversity (Decision VII/31) (<http://www.biodiv.org/programmes/areas/island/>). Island biodiversity was identified as the item for in-depth consideration at the eighth meeting of the Conference of the Parties to be held in Brazil in 2006. A preparatory process was set up for the work of the Subsidiary Body on Scientific Technical and Technological Advice (SBSTTA) which includes an Ad Hoc Technical Expert Group and also draws on the outcome of the international meeting of Small Island Developing States (SIDS) for the review of the Barbados Programme of Action (BPOA) (<http://www.sidsnet.org/docshare/other/BPOA.pdf>).

Right: Great Tobago, British Virgin Islands: the whole island is a National Park and is home to the largest colony of roosting magnificent frigate birds (*Fregata magnificens*) in the eastern Caribbean. The tree cacti in the foreground are *Opuntia rubescens* (Cactaceae). (see page 11) (Photo: Colin Clubbe)



The BPoA was a United Nations initiative developed at the Global Conference on the Sustainable Development of Small Island Developing States held in Barbados in 1994. Small Island Developing States are defined as small islands and low-lying coastal countries that share similar sustainable development challenges, including small population, lack of resources, remoteness, susceptibility to natural disasters, excessive dependence on international trade and vulnerability to global developments. In addition, they suffer from lack of economies of scale, high transportation and communication costs, and costly public administration and infrastructure. The Programme of Action set forth specific actions and measures at national, regional, and

international levels in support of the sustainable development of Small Island Developing States. In 2002, the United Nations General Assembly called for a comprehensive review of the BPoA, which will take place in Mauritius in January 2005 (<http://www.un.org/smallislands2005/>).

Another important initiative with the aim of contributing to the economic, social and cultural progress of islands throughout the world, as well as encouraging protection of island environments and protection of resources is the International Scientific Council for Island Development (INSULA) created in 1989 as a non-profit making, non-governmental organisation (<http://www.insula.org/>).

Biodiversity provides goods and services in support of economic development and is a fundamental resource underpinning the achievement of the Millennium Development Goals (<http://www.developmentgoals.org/>). For instance, biodiversity helps reduce poverty by providing plants for food, health, fuel, clothing and shelter and supports economic development through trade, tourism and indirectly by maintaining the planet's basic environmental balance and ecosystem stability (FAO, 2002; Koziell & McNeill, 2002; SCBD, 2002). One item that will therefore be widely discussed in Mauritius will be how islanders can be supported in making more productive use of their biological diversity to generate resources for development.

In view of the international attention presently being focussed on small island development needs, this issue of *BGjournal* attempts to illustrate the special problems of islands and how botanic gardens can support conservation of island biodiversity and thus contribute to economic and sustainable development.

## References

- ➔ FAO, 2004. Challenges and emerging issues in agriculture, forestry and fisheries. Food and Agriculture Organization of the United Nations, Rome. Paper prepared for the Inter-Regional Conference of Small Island Developing States in January, 2004 [[http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/DOCREP/006/Y5203E/Y5203E00.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/006/Y5203E/Y5203E00.htm)].
- ➔ Koziell, I. & McNeill, C.I., 2002. Building on hidden opportunities to achieve the Millennium Development Goals: poverty reduction through conservation and sustainable use of biodiversity. UNDP World Summit on Sustainable Development Equator Initiative Policy Series. [[http://www.undp.org/equatorinitiative/pdf/poverty\\_reduction.pdf](http://www.undp.org/equatorinitiative/pdf/poverty_reduction.pdf)]
- ➔ SCBD, 2002. Biological Diversity and Tourism: Development of Guidelines for Sustainable Tourism in Vulnerable Ecosystems. Convention [<http://www.biodiv.org/doc/publications/ecotour-brochure-en.pdf>]

# The challenge of the GSPC – how the Seychelles, a small tropical island state, is responding

Even though the floral diversity of the Seychelles islands cannot compare with the richness of mainland tropical rainforest, many primitive characters have been preserved in Seychelles' relict species, such as the Jellyfish tree (*Medusagyne oppositifolia*) and the renowned Coco-de-Mer palm (*Lodoicea maldivica*). The archipelago's northern granitic islands have an ancient geological origin as part of the Gondwana super-continent and many endemic species have close affinities with taxonomic groups in India, Asia, Africa and especially Madagascar. As a consequence the islands which form part of the Western Indian Ocean Centre of Plant Diversity, are considered a Biological Hotspot and also form the western boundary for groups such as dipterocarps and pitcher plants (Nepenthaceae). The southern coralline islands also have unique plant species, particularly Aldabra Atoll, which is a World Heritage Site. Although the Seychelles islands were only settled in 1770, and many islands are clothed with verdant vegetation, much of the native forest cover has been considerably modified and the majority of native species are now threatened by a combination of human activities and alien invasive species.

Seychelles has a population of only 81,000, with no graduate botanists and no university or scientific research institute. How is it that this small island nation has been amongst the first to respond to the call of the Global

Strategy for Plant Conservation (GSPC) to formulate a National Strategy? There are a number of reasons.

Seychelles has for a long time put environmental issues high on the political agenda and it was the second country to sign the Convention on Biological Diversity (CBD). So, perhaps Seychelles has a reputation to live up to! However, in spite of having two ten-year Environmental Management Plans and a National Biodiversity Strategy and Action Plan, plant conservation has often been neglected or superseded by other issues. Although government, NGOs, private islands and other organisations were working in the

plant conservation field, initiatives were being undertaken and funded in many different ways, with no coordination. So the GSPC came at the right time for Seychelles. Here was the means to bring plant conservation to the attention of Seychellois, bring everyone together to work towards common goals, and generate the human and financial capacity to deal with the threats to our native plant species.

Being a small country has its disadvantages, one of the biggest being the lack of specialised capacity. However, one of the advantages of this small size is the ability to bring people together when there is something



Left: Mahé  
Island view,  
Seychelles with  
*Nepenthes  
pervillei* Blume  
in foreground  
(Photo: Peter  
Wyse Jackson)

Right: Open capsules of Jellyfish tree (*Medusagyne oppositifolia*), the only species in a Seychelles endemic genus (*Medusagynaceae*) with very primitive floral characteristics and tiny simple winged seeds.



There is currently no natural regeneration of this species in the wild and ex situ propagation is difficult. (Photo: Angelika Fischer)

important to do. For the formulation of the National Strategy for Plant Conservation (NSPC), all it needed was an enthusiastic group of plant conservationists to galvanise the action (with, we have to admit, some encouragement from Peter Wyse Jackson, Secretary General of Botanic Gardens Conservation International). Thus the Botanical Gardens (part of the Ministry of Environment and Natural Resources) collaborated with a young NGO, the Plant Conservation Action group (PCA), to set the process in motion.

The strategy development process has been in four phases. First the two organisations identified the major issues relevant to plant conservation in Seychelles and drafted an outline strategy based on the GSPC objectives. Then came the two day workshop, to which all relevant stakeholders were invited. Small group work enabled participants to be productive and efficient, and by the end of the second day each group had presented its proposed targets to the workshop.

In the third phase the draft targets were further refined and agencies with potential to action the targets were also identified. The fourth phase has been collating everything into an appropriate format for a national strategy, which should be printed by the end of 2004.

The implementation of the strategy will require further local networking but collaboration between the Botanical Gardens and PCA will continue. On the international front our partners, such as

the Geobotanical Institute in Zurich and Eden Project in England, will provide scientific support and other assistance. By 2005 an action plan should be defined, with a major review of achievements in 2007. By 2010, all targets should be achieved.

The targets for Seychelles' national strategy are based on the five objectives that structure the GSPC. One emphasis is on consolidating our knowledge of vascular plants (noting the huge gaps in our knowledge of 'lower plants'), quantifying information and prioritising species for immediate further conservation action. It will be important to make information more readily accessible, increase our research capacity, and make maximum use of the plant conservation knowledge and expertise that already exists.

The Botanical Gardens has made an excellent start to ex situ conservation of native species and this needs to be continued. Active management of invasive species, which are the greatest threat to native species at the moment, is another priority target, and includes restoration practices, as well as improved phytosanitary regulations and inspections. Although there are no indigenous agricultural crop varieties, many varieties were brought in during colonial times and these need to be conserved. Sustainable use of native species such as the Coco-de-mer and medicinal plants is another important issue.

Funding always seems to be a problem in small places with small economies and needs to be addressed, as does increasing capacity in plant conservation personnel. Networking within the country and with both regional and international organisations will also be important. Environmental education is already well established in schools and people are reasonably aware of environmental issues, so we need to build on this, with further emphasis on plant conservation.

**Katy Beaver, Plant Conservation Action group**  
**Denis Matatiken, Director, National Botanic Gardens**  
**Didier Dogley, Director General, Nature Conservation, Division of Environment**  
**Christoph Kueffer, PhD student, Geobotanical Institute, ETH Zurich.**

**Denis Matatiken, National Botanic Gardens, P.O Box 445, Victoria, Mahé, Seychelles.**  
**Tel: +248 224644,**  
**Fax: +248 266903,**  
**E-mail: [boga@seychelles.net](mailto:boga@seychelles.net),**  
**Internet: [www.geobot.umnw.ethz.ch/staff/kueffer](http://www.geobot.umnw.ethz.ch/staff/kueffer) (to download copies of the PCA newsletter *Kapisen*).**

Right: Participants at the national plant conservation workshop (Photo: Peter Wyse Jackson)





# Conservation on St. Croix, US Virgin Islands: the role of St. George Village Botanical Garden

## A brief vegetation history

St. Croix, at 84 square miles, is the largest and also the most remote of the US Virgin Islands. As on many of the other islands in the Caribbean, very little native vegetation remains, and what does remain is severely disturbed, permeated by introduced and often invasive species. The same goes for the native fauna that survives only where introduced and feral animals - especially mongoose, cats and dogs - have not penetrated.

When Columbus first saw St. Croix it was lush and green with flowing rivers and a dense montane forest. European (mainly Danish) exploitation during the 18th and 19th century sugar-cane boom stripped most of this native vegetation to create cane fields, cattle pasture or to provide lumber for building, charcoal and for cooking. Non-native species, which now dominate some areas of the island, were introduced for fodder. These include the Central American *Leucaena leucocephala* (locally called Tan tan) and the African *Urochloa (Panicum)*



*maxima* (called Guinea grass). Vegetation loss caused the rivers to dry up and the already poor soils were further impoverished. Some of the more inaccessible places and also the dry east end of the island have remnants of what was here before Columbus but, for the most part native species are scattered and little undisturbed native vegetation remains.

## Professional conservation resources

Professional biologists on St. Croix are scarce. The University of the Virgin Islands has an extension service with professional staff as does the Department of Agriculture. The National Parks Service, the US Fish and Wildlife Service (USFWS), the Department of Planning and Natural Resources and The Nature Conservancy all have skilled and knowledgeable staff. The botanical garden has one trained biologist (the author of this paper). We all help one another; occasionally we work together but everyone is stretched far too thin to constitute an effective conservation force.

This looks like a depressing picture and yet, with tiny resources, conservation is alive and well on St. Croix. Small dedicated groups of people, including the professionals listed above, are doing all they can to stabilize what we have left, to restore what we can and to create a climate of respect and care for our natural



heritage. Several not for profit organisations, including St. George Village Botanical Garden (SGVBG), are part of a loosely knit conservation initiative. Here are just three examples of current and future programmes:

## Documenting what we have

There is no current Flora of St. Croix. The nearest (but geologically very distinct) island with a published Flora is the island of St. John, some 40 miles away across a 2-mile-deep oceanic

Above: *Coyphatan* (Gebang palm) from Asia with one of the Garden's buildings, an eighteenth century slave house in the background  
Left: General view of the Garden showing the Great Hall



Above: Veronica Gordon, weed woman of the island of St. Croix is wearing jewelry she created from local seeds and is holding two baobab fruits. Containers made from calabash fruits hang in the background.

Right: The Garden's new propagation unit for native species, built with the help of a US Fish and Wildlife Service grant

trench. Applicability of this to St. Croix is limited. Other West Indian Floras have limited value in answering questions about the identity and status of plants found in the wild. So, the identification and naming of native plants is, at best, difficult even for a knowledgeable field worker. SGVBG is trying to address this with a group of three taxonomically competent volunteers. Working in the non-air-conditioned basement of an 18th century plantation house they have built up a 4,000-plus specimen herbarium of (mostly) native species and have recently published, on the Garden's website, a taxonomically correct check list of the 1,200 native and established species we know are on St. Croix. We have a long way to go but this is a start.

### Native habitat restoration

SGVBG is working with USFWS to restore the native vegetation of two wildlife preserves, Sandy Point (a coastal habitat and an important

nesting place for the Leatherback Turtle, *Dermochelys coriacea*) and Green Cay (a small island and one of the two remaining habitats for the endemic St. Croix Ground Lizard, *Ameiva polops*). Seed of native species from these two habitats is being collected and germinated in a propagation unit built with a small grant from USFWS. Garden volunteers are growing these plants to planting-out size and, very shortly, we will be planting them back in the wild.

### Developing plant awareness in kids: a career focussed approach

Respect for and knowledge of the plant world is rare on St. Croix. A desire to work with plants is even rarer as the legacy of the cane plantation era is still with us; working with plants is still seen in terms of slavery; harsh treatment and back-breaking work in the tropical sun, certainly no career for any smart kid to aspire to. A consequence is that agriculture is poorly developed and teachers with the skills and background to inspire kids to study or even consider plants are in short supply. We are attempting to break this barrier with the imaginative use of a Department of Labor grant called *School to Work*. Its purpose is to help kids between the ages of 8 and 13 to begin thinking about their future careers.

Some parts of this are easy. A day away from school in a Garden sounds like fun. *School to Work* is about

earning a living and the kids and teachers are naturally interested; the grant will pay for their transport so there are no financial barriers to their attending. But the success of a programme such as this is based almost entirely on the magnetism of the tutor. In the wrong hands we have no more than a group of kids that had a nice day away from school; with the right tutor we have converts to conservation. We were looking for someone:-

- with a personality and conviction as powerful as an Old Testament prophet;
- to whom the kids could immediately relate as a role model;
- who had developed a successful business based on his/her knowledge of plants;
- who could talk about other careers that can be developed from a knowledge of plants - not just farming and landscape work but pharmacy, tour-guiding, craftwork and so on;
- who had a comprehensive local and scientific knowledge of plants; and
- who could show how our lives depend on plants and could persuasively show that we need to conserve them.

The ideal individual would have several other personal qualities: He/she must be from the West Indies, preferably black and so can relate directly to the kids' backgrounds; he/she must have a deep respect for the natural world and show it in the values they possess.



---

We had a pretty difficult position to fill. But we found not just one but two people to take on this challenging assignment.

The first is Ras Lumumba Corriette from the island of Dominica. Lumumba runs a successful ecological tour company on St. Croix. He has both a folkloric and a scientific knowledge of ethnobotany, and is a master at demonstrating the practical uses of plants. He is a Rastafarian and a vegan and believes in a gentle and respectful relationship with nature. Most important he is a charismatic individual who can make the world of plants fascinating to kids like no one else I have ever met. The second role model is Veronica Gordon, St. Croix weed-woman (herbal medicine practitioner) who also creates wonderful craft objects and jewelry from local plant materials. Most important she has a built a successful career based on knowledge of plants, something to which the kids can relate.

Having located the two ideal tutors and got their commitment, the rest was a matter of scheduling and finances: this was expertly undertaken by Marilyn



Left: School to Work: kids learn about the value of plants from Lumumba



Chakroff, a skillful and knowledgeable educator who had recently coordinated a spectacularly successful Eco-Fair at the Garden (which connected over 1,000 kids with the natural world in a fun, informal setting).

This year some 495 kids and 56 teachers (who have probably learned as much as the kids) have attended this stellar programme. We hear nothing but praise from those who have attended. We know we have made some friends and also, we

sincerely hope, a few converts to the need to look after the plants on which all of us depend. We are now, with the help and expertise of the Curriculum Center (a key element in the St. Croix educational system), working on a documentary video production that records, for future use, the power and excitement of this programme.

Far Left: Ras Lumumba Corriette: an inspired communicator about plants

**Brinsley Burbidge**  
**Executive Director**  
**St. George Village Botanical Garden**  
**27 Estate St. George**  
**Frederiksted, 00840 St. Croix**  
**Virgin Islands, U.S.A.**  
**Tel/Fax: +809 692 2874**  
**E-mail: [brinsley@viaccess.net](mailto:brinsley@viaccess.net)**  
**Internet: [www.sgvbg.org](http://www.sgvbg.org)**

# Building capacity and developing botanical infrastructure for conservation: a case study from the British Virgin Islands

Right: Field identification workshop Gorda Peak National Park (Photo: Colin Clubbe)

## Introduction

The adoption of the Global Strategy for Plant Conservation (GSPC) by the Conference of the Parties to the CBD in April 2002 was both a triumph and a major challenge for the global plant conservation community. The 16 outcome-orientated targets for the conservation and sustainable use of the world's plant diversity are ambitious, but are an important starting point if we are seriously going to reverse the current biodiversity crisis. The need for *building capacity for the conservation of plant diversity*, encapsulated in Targets 15 and 16, are key to the delivery of the Strategy, especially in the biodiversity rich, resources poor areas of the world. International biodiversity institutions such as the Royal Botanic Gardens Kew are ideally placed to respond to these challenges, and have been providing training opportunities for many years. A powerful alumnus of more than 300 individuals from 100 countries have attended one of our international diploma courses at Kew, many run in association with BGCI, and many regional courses have been held in association with in-country partners ([www.kew.org/education/highered.html](http://www.kew.org/education/highered.html)). A twice yearly newsletter, *Kew OnCourse*, keeps the network in touch and provides a vehicle for the exchange of views and experiences.

The adoption of a new thematic programme, Island Biodiversity, at COP7 of the CBD recognises the unique ecosystems and high endemism



of islands, together with their fragility and susceptibility to change. For island conservationists this timely opportunity of responding to both this new thematic area and delivering the targets of the GSPC provides a challenging and exciting framework in which to showcase their work.

This case study highlights activities from a 6-year collaboration with the British Virgin Islands (BVI) National Parks Trust (NPT) to help conserve the botanical diversity of this unique Caribbean archipelago and help build capacity and botanical infrastructure for the long term conservation of plant resources for future generations of BV Islanders. Much of this work has been funded by the U.K. Government's Darwin initiative ([www.darwin.gov.uk](http://www.darwin.gov.uk)).

BVI is a U.K. Overseas Territory (UKOT) and as such comes under the U.K.'s ratification of multi-lateral environmental agreements such as CBD, RAMSAR and CITES. Like many UKOTs and other insular regions globally the conservation capacity rests with a few over-worked individuals in government or non-government organisations. An important network which exists to help UKOTs is the U.K. Overseas Territories Conservation Forum ([www.ukotcf.org](http://www.ukotcf.org)) a group of U.K. mainland and Territory-based biodiversity institutions and individuals devoted to providing advice and promoting the coordinated conservation of the diverse and increasingly threatened plant and animal species and natural habitats of UKOTs.

## Developing botanical infrastructure

The starting point for conservation is to know what you have and so the early phases of the Darwin projects have been inventory work and the production of plant checklists for National Parks, including Gorda Peak National Park on Virgin Gorda, the Anegada Ramsar site extending now to the whole island of Anegada under the current Darwin project ([www.seaturtle.org/mtrg/projects/anegada/](http://www.seaturtle.org/mtrg/projects/anegada/)). This includes identifying non-native species and identifying their potential risk of becoming invasive and possible solutions (e.g. *Scaevola sericea* on Anegada). Training workshops in plant identification, inventory and monitoring have been held and the need for the establishment of a national plant reference collection was identified as a critical infrastructure need. A small herbarium has been established at the J.R. O'Neal Botanic Gardens and a full set of herbarium specimens collected during the project has been mounted and labelled at Kew and will be repatriated to the BVI herbarium to be available for a wide range of studies. Raymond Walker, programme co-ordinator for BVINPT, has successfully completed Kew's international diploma course in herbarium techniques and will be curating the collection. We are working on conservation assessments of endemic plants and a red-listing workshop has been held which resulted in the development of an initial red list for BVI (Pollard & Clubbe, 2003), based on endemics occurring on the islands of Anegada and Virgin Gorda. This is being extended as more islands are investigated including the island national park of Great Tobago, home to the largest roosting colony of magnificent frigate birds (*Fregata magnificens*) in the eastern Caribbean (see photo page 4).

A seed bank has been established at the J.R. O'Neal Botanic Gardens and a seed collecting programme is underway as part of an ex situ conservation strategy which also involves horticulture training and the establishment of all endemic plants in cultivation (see Box - *Cordia rupicola* case study).

## The botanic garden as a conservation showcase

Botanic gardens have a broad appeal and are visited by a wide range of people. Visitors are a captive audience for the length of their visit and this presents us with the perfect opportunity and challenge to tell stories about the importance of plants in our daily lives and to showcase the actions being undertaken to conserve plant diversity.

The J.R. O'Neal Botanic Gardens is a 2.87 acre piece of tranquillity in the heart of Road Town, the capital of BVI on the island of Tortola. Founded in 1979 on the site of the original Agricultural Experimental Station, it is now managed by BVINPT who with Kew's help are re-defining the role of the collections and the priorities of the garden. The aim is to concentrate more on the indigenous flora, threatened plants and to act as a showcase for the work that NPT are doing with in situ conservation within the National Parks System. A strategic planning workshop has been held which developed a mission statement, programme areas with strategic objectives and a work plan for the botanic gardens. Horticulture training workshops are planned for 2005 as part of the Darwin project. Other outputs include a conservation poster series on the Threatened Plants of the BVI and new interpretation in the garden.

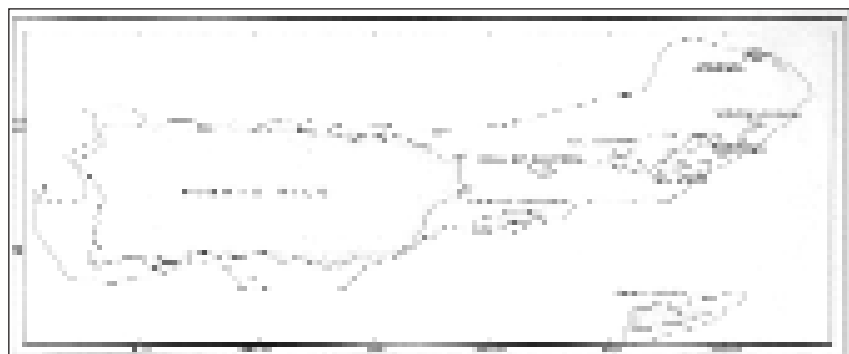
## The future

Island ecosystems are interconnected, diverse and fragile. By identifying long-term partnerships, meeting training needs and helping establish the critical botanical infrastructure island conservations will have the toolkit to help conserve these unique fragments of the world and botanic gardens can

provide the perfect venue to tell people about their work, inspire visitors and raise money for their vital conservation work.

**Acknowledgement** My thanks to all my colleagues in the BVI, at Kew and other U.K. institutions and internationally who have provided many hours of fruitful discussions and debate here. Conservation is a collaborative undertaking and the work described here would not have been possible without the commitment of the many people who have been involved with the fieldwork, training and follow-up activities referred to in this article.

Below: J.R. O'Neal Botanic Gardens – front entrance dominated by an avenue of Caribbean royal palms (*Roystonea oleracea*) (Photo: Colin Clubbe)



Left: Puerto Rican Bank - A geographical, biological and geological province which was a continuous land mass 14,000 years ago when sea levels were 100 m lower than present.

## ***Cordia rupicola*: a critically endangered Puerto Rican Bank Endemic**

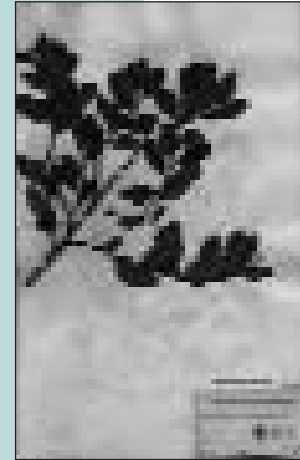
Prior to the start of Darwin project work the status in the wild of *Cordia rupicola* Urban (Boraginaceae), a small perennial shrub of the Puerto Rican Bank (see map), was uncertain. Originally described as endemic to a small region of Puerto Rico in 1899 by Urban, reports in the literature in the early 1990s cited it as occurring in Anegada, BVI, but without any herbarium specimens lodged for verification. The Puerto Rico site is on private land which has been developed for housing and the population thought extirpated, leaving Anegada as the only known location. On the basis of these reports *Cordia rupicola* was put forward as a candidate species for protection under the US Endangered Species Act and it was listed as Endangered in the 1997 IUCN Plant Red List (Walter & Gillett, 1998).

Research in the Kew herbarium discovered a hitherto unknown type specimen of *C. rupicola* collected by Urban in 1899. This has been digitally scanned and the image repatriated to BVI. We used this image and information from published accounts of likely habitats to develop a dedicated sampling strategy to look for it on Anegada. The first individual was discovered in 2000 within the Ramsar site near Flamingo Pond. Specimens collected have been lodged in the herbaria at Kew (K) and the Smithsonian (U.S.A.) and have been verified as *C. rupicola*. Further fieldwork has established that it is

relatively widely distributed in the western region of Anegada (Clubbe *et al.*, 2004). On the basis of our up-dated knowledge of its distribution in the wild we have re-listed *C. rupicola* as critically endangered (Clubbe *et al.*, 2003, Pollard & Clubbe, 2003).

The 2003 wet-season in BVI proved to be an excellent one for fruiting and seed has been collected of *C. rupicola* and sent to the Millennium Seed Bank (MSB) at Kew, Wakehurst Place ([www.kew.org/msbp/](http://www.kew.org/msbp/)) as part of the Foreign and Commonwealth funded programme of ex situ conservation for the UKOTs, and a contribution to Target 8 of the GSPC (Alton, 2004). Seeds have been cleaned, dried and hermetically sealed into glass vials. Half of these have been lodged in the MSB and half have been sent back to BVI where they are stored in the local seed bank in the J.R. O'Neal Botanic Garden, established by this project. Data relating to viability testing and germination testing have also been repatriated to BVI to help in getting *C. rupicola* established in the botanic garden as part of an endemic plant display to raise awareness about indigenous floras, endemic plants and conservation issues. Seedlings from the germination trails at the MSB are being incorporated into the living collections at Kew as part of an island floras exhibit.

A conservation management plan is being developed for the long-term survival of *C. rupicola*.



Right: Herbscan of Urban's 1899 type of *Cordia rupicola*

Right: Habit of *Cordia rupicola*

## **References**

- ➔ Alton, S. 2004 The Millennium Seed Bank Project International Programme. *BGjournal* 1 (1): 15-16.
- ➔ Clubbe, C., Gillman, M., Acevedo-Rodriguez, P. & Walker, R. 2004 Abundance, distribution and conservation significance of regionally endemic plant species on Anegada, British Virgin Islands. *Oryx* 38 (3): 342-346.

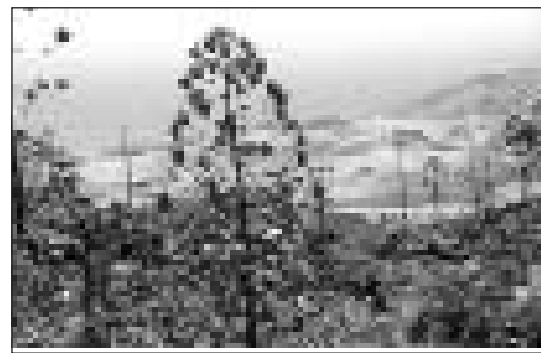
- ➔ Clubbe, C., Pollard, B., Smith-Abbott, J., Walker, R. & Woodfield, N. 2003. *Cordia rupicola*. In: IUCN 2003. *2003 IUCN Red List of Threatened Species*. <[www.redlist.org](http://www.redlist.org)>. Accessed on 31 October 2004.
- ➔ Pollard, B. & Clubbe, C. 2003 *Status Report for the British Virgin Islands' Plant Species Red List*. Royal Botanic Gardens, Kew, U.K.

- ➔ Walter, K.S. & Gillett, H.J. (eds) 1998. *1997 IUCN Red List of Threatened Plants*. IUCN-The World Conservation Union, Gland, Switzerland and Cambridge, U.K.

**Colin Clubbe**  
**Royal Botanic Gardens, Kew**  
**Richmond, Surrey, TW9 3AB, U.K.**  
**Tel: +44 (0)20 8332 5637**  
**Fax: +44 (0)20 8332 5640**  
**E-mail: [C.Clubbe@rbgkew.org.uk](mailto:C.Clubbe@rbgkew.org.uk)**  
**Internet: [www.kew.org](http://www.kew.org)**

Author: Tanguy Jaffré

# Conservation programmes in New Caledonia, western Pacific: in place for the dry forest, but urgently needed for the ultramafic vegetation



New Caledonia is a French Overseas Territory in the western Pacific. It is world renowned for its exceptional biodiversity (Myers, 1988) and particularly for its flora which comprises 3,261 species of vascular plants. Furthermore 1,423 species or 73.3 per cent of the total, as well as 110 genera and 5 families, are endemic.

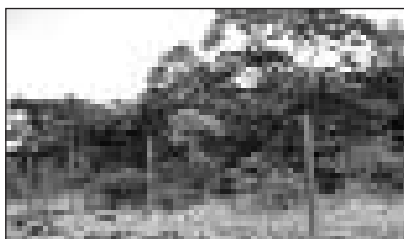
The dry forest (or sclerophyll forest), which covers less than 2 per cent of the archipelago almost ceased to exist about 10 years ago (Bouchet *et al.*, 1995), is now the subject of an important programme involving research, use of conservation techniques and restoration ([www.foretseche.nc](http://www.foretseche.nc)). Some dry forest remnants have been protected by the removal of ungulates (deer and cattle); their recovery is being monitored and rare species are being propagated in nurseries with a view to their reintroduction into the protected sites.

However, the dry forest, which will benefit from this well-designed conservation programme, contains only 10.4 per cent of the endemic species of the country. Among the vegetation types most at risk in New Caledonia at present are the forests and shrubby maquis on ultramafic rocks. These rocks are the source of minerals such as nickel and cobalt and are being extensively exploited. New Caledonia is one of the world's largest producers of nickel. The mining of these minerals, which is accompanied by clearing of the vegetation and

sometimes its burial under debris, will increase considerably during the course of coming years with intensified mining and industrial activity (doubling of the production of nickel by ERAMET-SLN, and the initiating of mining projects by Koniambo Falconbridge and INCO-Goro Nickel).

The maquis and the forests on ultramafic rocks contain 2,137 species of vascular plants, which is 65 per cent of the total flora. Furthermore 81.4 per cent of these species are endemic and 1,145 of them (47.2 per cent of the endemic flora) are found exclusively on ultramafic rocks. It should also be emphasised that 40 species (all endemic) of conifer are found on this rock type and 27 of them are restricted to it. This is also the case for 37 of the 104 endemic genera. In addition, of the 392 rare or threatened species of the New Caledonian flora (Jaffré *et al.*, 1998), 280 are found in these vegetation types on ultramafic rocks and 250 of them are restricted to them.

In the face of these facts, a joint programme should be established, modelled on the "Dry Forest Programme", with the aim of increasing knowledge of the most threatened vegetation types of ultramafic rocks and of conserving and restoring their floristic and ecological diversity. This seems more than ever to be an urgent necessity, which should be accorded high priority.



## References

- ➔ Bouchet, P., Jaffré, T. & Veillon, J.M. 1995. Plant extinction in New Caledonia, protection of sclerophyll forest urgently needed. *Biodiversity and Conservation* 4: 415-428.
- ➔ Jaffré, T., Bouchet, P. & Veillon, J.M. 1998. Threatened plants of New Caledonia. Is the system of protected areas adequate? *Biodiversity and Conservation* 7: 109-135.
- ➔ Jaffré, T., Morat, P., Veillon, J.M., Rigault, F. & Dagostini, G. 2001. Composition and characteristics of the native flora of New Caledonia. Documents scientifiques et techniques, II: 4. IRD Nouméa.
- ➔ Myers, N. 1988. Threatened biotas: "Hot Spots" in tropical forests. *Environmentalist* 8: 1-20.

**Tanguy Jaffré**  
**Laboratoire de Botanique et d'Ecologie Végétale Appliquées**  
**IRD - Institut de recherche pour le développement, Centre de Nouméa**  
**BP A5 Nouméa - 98848 Nouvelle-Calédonie**  
**Tel: +687 26 10 00,**  
**Office: +687 26 07 13,**  
**Fax: +687 26 43 26**  
**E-mail: [jaffre@noumea.ird.nc](mailto:jaffre@noumea.ird.nc)**  
**Internet: <http://www.ird.nc>**

Above: A mining landscape in the Poro region. In the foreground, maquis dominated by *Araucaria rulei*, an endangered species.

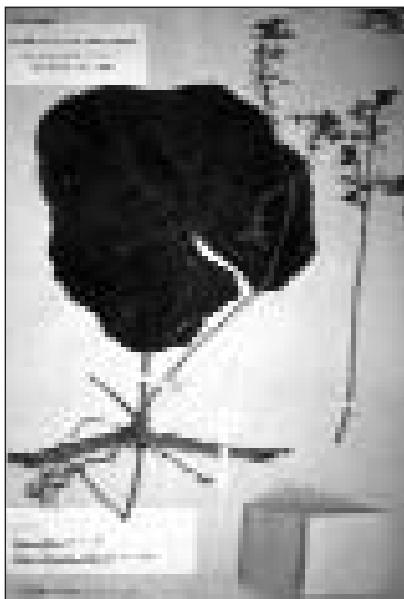
Below Left: A dry forest remnant protected by a fence after the removal of deer (Réserve Metzdorf. Poya Commune). (The main tree of the canopy is *Terminalia cherrieri* (Combretaceae), a critically endangered species).

# Plant conservation in Galapagos, Ecuador

Right: *Lecocarpus darwinii* (Endangered, yellow flowers), and *Calandrinia galapagosa* (Critically Endangered, tall stems) growing together on San Cristobal Island.

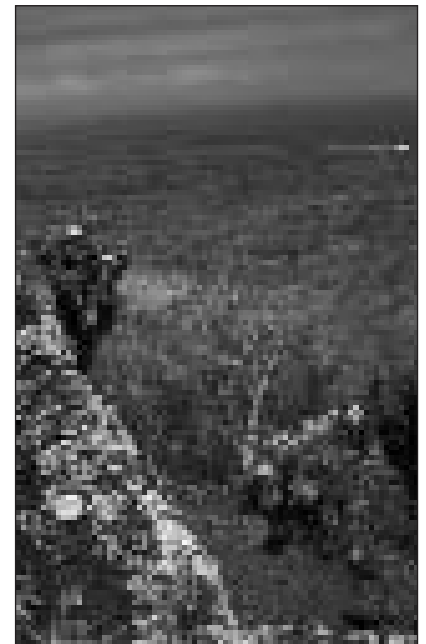
Galapagos is unique among tropical archipelagos for two reasons: it has lost relatively little of its native biodiversity, owing to its late settlement by humans (not until the 19th century), and more than 96 per cent of its land area was designated as the Galapagos National Park, 45 years ago, when the human population was still no more than 2,000. However, despite these two factors in favour of the 40 per cent of the native plant and animal species that are endemic to the islands, the Galapagos ecosystem is suffering degradation resulting from human activities, and the signs are clear that Galapagos is on the same path to extinctions that has been followed by other island groups.

Right: *Sicyos villosa*, only ever collected by Charles Darwin, who considered it common on Floreana Island but it has never been seen since



Several Galapagos endemic animals have become extinct in historical times, notably some of the giant tortoises, rice rats and land snails, but so far only three endemic plants seem to have become extinct: *Delillia inelegans* and *Sicyos villosa* from Floreana Island and *Blutaparon rigidum* from Santiago. Charles Darwin was the first and last person to record the two Floreana species, when he found the *Sicyos* "in great beds injurious to vegetation"! It is not known why these two species disappeared, but Floreana was the first island to be settled, a few years before Darwin's visit. *Blutaparon*, last seen in 1906, is suspected to have been extinguished by feral goats as it is an amaranth, a family favoured as food by goats. During the 20th century, Santiago supported a goat population that grew to 100,000 before an eradication campaign began in 2003.

Despite the apparently almost intact flora, many more species have severely decreased in numbers or area, and will be lost in the near future unless their decline can be reversed. The Galapagos endemic flora has been red-listed in its entirety by the Botany Department of the Charles Darwin Research Station (CDRC) and the IUCN Galapagos Plant Specialist Group, and the data are alarming. Over 60 per cent of the endemic taxa are ranked as threatened. Even though two-thirds of these are "only" Vulnerable, mainly owing to their naturally small ranges, and have not yet declined (as far as is known), they are naturally susceptible



to the introduction of new pests or diseases, which could quickly decimate any species restricted to a single island. Conservation priorities lie with the 20 taxa that are classified as Critically Endangered and the 30 Endangered, which have all declined.

The figure of 60 per cent of endemic taxa threatened may seem high, perhaps even over-inflated, but it is typical of tropical oceanic island floras. It dramatically illustrates the extreme vulnerability of island biodiversity to human-mediated change. World-wide, habitat destruction is the main threat to plant species, and this has also been true for most islands. However, increasingly, introduced species are being recognised as the chief current and future threat to oceanic island endemic plants. In Galapagos, habitat loss has caused the decline of many plants, especially when agricultural



areas were created in four of the seven islands that have wet highland habitats, but the continuing decline in Galapagos plant species is now due to pressure from introduced herbivores and plant invaders. In many cases, populations of endemic plants, that have been reduced by past habitat clearance, are now especially vulnerable to pressure from introduced species.

The policy of the Galapagos National Park has always been to conserve the biodiversity of the islands in situ, including the full range of its genetic variability. The plant research and management programmes take this objective as the starting point, and the threatened plants programme comprises five levels of activity:

1. establishing the baseline of knowledge;
2. monitoring for change;
3. prioritizing the problems;
4. biological studies of priority species and communities; and
5. management including protection and restoration.

**Establishing the baseline** One tends to think of Galapagos as well-studied, but there are still big gaps in the knowledge of the abundance and distribution of many species, and many parts of the islands have never been visited by botanists. Furthermore, much of the information is old, and fundamental changes have occurred in the archipelago in the last 40 years. In 1998, a programme of botanical surveys was begun, focussing on the endemic and threatened plants, especially of areas where previous



records are scarce or absent. With more than 130 islands on which land plants can grow, this will take several years, but the programme has already yielded surprises, including the rediscovery of two plants that were thought to be extinct, *Linum cratericola* and the nominate subspecies of *Scalesia atractyloides* on Santiago. On virtually every field trip new populations of threatened plants are found which puts the red-listing on a firmer footing and directs conservation action to the right places.

**Monitoring for change** Populations need to be monitored to detect changes, and to distinguish declines caused by feral goats (for example) from fluctuations caused by natural events such as the El Niño cycle. Unfortunately this is expensive, and known populations of highly threatened species can only be visited once in a while. A full monitoring programme requires major, permanent financial resources that are not available.

**Prioritization** In the case of Galapagos plants, the basic step is red-listing. The most threatened species in Galapagos are identified; the assessments are comparable with those for other places through the IUCN system. This procedure helps decide management action. The specific action depends on the threat (including action to find out what the threat is, if it is not already clear), availability of effective conservation techniques, and ability to apply them in specific cases. Therefore the first action is often to undertake more research, if we do not have the answers to these questions.

**Biological studies** The priority threatened species are studied to understand the cause of decline or failure to recover and where to intervene to reverse the decline. Studies therefore often focus on population dynamics and reproductive biology. They are often undertaken as thesis projects by Ecuadorian and foreign students working at CDRS.

**Management** Management of threatened plants, where in situ conservation is the goal, consists essentially of protection and restoration. Protection of threatened



Galapagos plants often means control of a specific threat, such as goats, which is less focussed on an individual plant species than on the target introduced organism. However, interim protection, until the threat can be dealt with, is sometimes more plant-focussed, such as building fences to protect remnant populations or communities. Restoration of endemic plant populations is a relatively new element in the programme and will be increasingly important as species are identified that do not recover by themselves once the threat has been removed.

This does not mean that ex situ methods are completely ignored in Galapagos, but they are the last resort. At CDRS, nursery and shade house facilities are maintained to enable threatened species to be cultivated

Top: Walter Simbaña, at the site of his study plant, *Linum cratericola*  
 Above: A population of the Critically Endangered *Scalesia retroflexa*, fenced to protect it from feral herbivores  
 Left: *Linum cratericola*, once thought possibly extinct and found at only a single site, out of reach of goats, on Floreana Island



Above: *Scalesia atractyloides*, also thought possibly extinct but discovered surviving amid hostile lava on Santiago Island

when necessary, but only for temporary or experimental purposes, such as rearing plants for in situ restoration projects. There are no plans to establish extensive living collections, but it is hoped that a seed bank for Galapagos endemic plants will be started within the next two years. However, it is also hoped that no Galapagos plant species will ever depend on it!

Right: Santiago Island. Site of an extinct population of *Scalesia atractyloides*. It is hoped that the species will be re-established from plants maintained at Copenhagen Botanic Garden

The message from Galapagos is that, if one tropical archipelago can be saved in near-pristine, pre-human condition, it is here. Galapagos is iconic in that respect and if its biodiversity cannot be saved, it will be another damning indictment of humankind's management of the planet.

More information on plant research and conservation in Galapagos can be found at: [www.darwinfoundation.org/articles/botany1997-2003.pdf](http://www.darwinfoundation.org/articles/botany1997-2003.pdf)

**Alan Tye**  
**Charles Darwin Research Station**  
**Via Casilla 17-01-3891, Quito,**  
**Ecuador**  
**Tel: +593 5 526146/47**  
**Fax: +593 5 527013 ext 3**  
**E-mail: [atyefcdarwin.org.ec](mailto:atyefcdarwin.org.ec)**  
**Internet: [www.darwinfoundation.org](http://www.darwinfoundation.org)**

## How to restore an island

The integrated and strategic nature of the programme is illustrated by looking from another viewpoint: how to restore the vegetation of an island as a unit. Española and Santiago islands both suffered from introduced goats. The first step is therefore: deal with that threat. On Española, the smaller of the two, goats were eradicated in 1978. On Santiago they are being eradicated and a series of 20 enclosures (totalling about 40 ha) have been established to protect tiny fragments of the vegetation communities. Matched plots inside and outside the fences are regularly monitored to determine the detailed effects of goats on species and communities, in order to evaluate their eventual recovery without goats. On Española, 25 years of monitoring showed that the vegetation in general came back within 20 years of goat eradication, to resemble its status 100 years ago (as shown in

old photos). The endemics of the whole island have been surveyed and mapped and two species are apparently not recovering: the *Opuntia* cactus and *Lecocarpus lecocarpoides*, an Asteraceae now almost restricted to islets in the main bay of the island. The life cycle of the cactus is being studied to determine the critical stage for intervention to improve its regeneration. Preliminary results suggest that the very young seedling is highly vulnerable to damage, and it may be that so few seedlings are produced now, that all are killed by endemic birds and reptiles. Meanwhile, an attempt is being made to establish *Lecocarpus* at an additional site. On Santiago, active restoration will take place after the goats are eradicated when it becomes clear which species return and which do not. A population of *Scalesia atractyloides* which became extinct in the 1980s will be re-established at its old site from seed collected and grown in Copenhagen Botanic Garden, Denmark.



**Authors:** D.A. Burney, D. Bender,  
S. Perlman, C. Salvador and  
C. Wichman

# The National Tropical Botanical Garden: creating a Genetic Safety Net for Hawaii's vanishing flora

The Hawaiian Islands are the most isolated high islands in the world, located over 2,000 miles from the nearest continental land mass. Their isolation, together with a high diversity of habitat types, makes the Hawaiian flora one of the most unique in the world. Approximately 1,500 plant species are indigenous to the Hawaiian Islands, with perhaps the highest rate of endemism in the world at over 90%. Nearly half of the 114 species known to have become extinct in the U.S. in the first 20 years of the Endangered Species Act are in Hawaii. Humans have precipitated these extinctions

through the introduction of exotic plants, animals and diseases and the transformation of the land with fire, livestock and deforestation.

To try to stem the tide of extinction in the Islands, the National Tropical Botanical Garden (NTBG) Conservation Department has an integrated strategy that addresses threats and recovery needs at the species and landscape levels. The Genetic Safety Net (GSN) program provides a seamless sequence of conservation strategies through collection, curation, native plant nursery operation and a rapidly

growing ecological restoration and reserve management program that creates, enhances and manages habitats for rare plants in perpetuity.

The GSN list consists of 118 Hawaiian species that have fewer than 50 individuals remaining in the wild. NTBG has developed strict protocols for GSN collecting which include genetic sampling of populations, accurate GPS locations for individual plants and populations and the creation of high quality species distribution and survey maps.

Over the past 20 years, roughly two dozen species have been rediscovered by NTBG botanists that were thought to be extinct and about 20 new species have been discovered that were previously unknown to science.

The Native Plant Nursery Operation has developed techniques for nursery propagation of native plants from storage of propagules, appropriate germination techniques and other means of propagation to the organization of climate-controlled growth environments for large-scale plant stock production. This native plant nursery operation has produced thousands of plants that are well-established in the NTBG reserve and restoration area system and gardens. Capacity has greatly expanded with an extended native plant nursery facility now coming on-line.



Left: With the spectacular Limahuli Preserve for a backdrop, NTBG Acting Director Chipper Wichman "talks story" with visitors, explaining the need for conservation of native plants through Hawaiian legends

## Restoration and Natural Area Management

The overall strategy is to establish or enhance a sufficiently large area of habitat dominated by native species to provide suitable conditions within these native plant communities for new populations of GSN species and to monitor, protect and enhance existing populations on NTBG properties.

### Limahuli Preserve

Limahuli Preserve is the largest preserve in the system (990 acres). The 400-acre Upper Valley of Limahuli is mostly intact and is home to a great abundance and exceptionally high diversity of native plants and animals. Since 1992, the NTBG has actively managed Limahuli Preserve to protect and enhance the populations of native plants that are threatened by hurricanes, alien plants and feral ungulates. Among these are extant populations of 10 Federally Listed Threatened or Endangered plant species, a large nesting colony of Newell's Shearwater (a pelagic seabird), Hawaiian honeycreepers, Hawaiian owls and the endemic hoary bat. Since 1998, Limahuli Preserve has developed 10 acres of lowland wet and mesic forest restoration outplanting sites. Within these sites the restoration team has planted ca. 5,000 native, nursery-grown trees and shrubs, ca.

720 of which are specimens of Federally Listed Threatened or Endangered species and other at-risk species. A second major element crucial to the long-term protection of Limahuli is the construction of an ungulate-proof fence enclosing the entire Upper Valley of Limahuli to keep feral pigs and goats from the Preserve. The NTBG has received a sizeable grant from the US Fish & Wildlife Service to undertake the fencing project in 2005.

### Lawai Kai Coastal Restoration

The Lawai Kai coastal project is a 3-acre native plant restoration site located at the mouth of Lawai Stream, on the south shore of Kaua'i. It is near paleoecological and archaeological sites, which provide information on the local ecological history and guided the restoration plan. A goal of this project is to improve coastal and lowland forest habitat for more than 20 rare native plant species and to remove a thick mat of alien grass from the beach strand to enable sea turtle to nest. Several at-risk species are being planted within this site – including *Sesbania tomentosa*, *Munroidendron racemosum*, *Hibiscadelphus distans*, *Pritchardia aylmer-robinsonii* and others.

### Ka'upulehu Preserve, Kona, Hawaii

Ka'upulehu is a 6-acre dry forest preserve located in North Kona on the

Big Island, Hawaii. Though small in size, this preserve has been fenced continuously since the 1950's and unlike much of the surrounding forest, Ka'upulehu contains an extraordinarily rich native dryland flora that is exceptionally intact. Maintenance of firebreaks around the preserve and replacement of the perimeter fence which keeps feral goats from entering are pressing management needs for this small preserve.

### Kahanu Gardens, Maui

At Kahanu Gardens, NTBG manages an extensive native *hala* woodland (*Pandanus tectorius*) and ethnobotanical plants, as well as the largest pre-contact Hawaiian *heiau* or stone temple.

### McBryde Gardens on Kaua'i

Under support from the NTBG Fellows Program, NTBG's McBryde Gardens on Kaua'i has initiated a dry forest restoration project designed to support 20 or more plants on the US Endangered Species List and dozens of other rare dry-adapted plants.

Under contractual collaborations, NTBG staff assist large landowners with restoration projects (e.g. Grove Farm, Inc., the Bette Midler Trust) and the Federal-State collaborations to restore the sea-bird colonies on tiny Lehua Islet off Ni'ihau.

NTBG staff fervently hope that, with the continued application of a multi-faceted approach to native plant conservation, many of the 118 species of GSN-designated rare plants will soon be firmly back on the road to permanent recovery.

**D.A. Burney, D. Bender,  
S. Perlman, C. Salvador and  
C. Wichman**  
National Tropical Botanical  
Garden, 3530 Papalina Rd.,  
Kalaheo, HI 96741, U.S.A.  
Tel: +1 (808) 332-7324  
Fax: +1 (808) 332-9765  
E-mail: [dburney@mail.ntbg.org](mailto:dburney@mail.ntbg.org)  
Internet: [www.ntbg.org](http://www.ntbg.org)

Right: Participants in the Horticultural Intern program at NTBG have worked hard in recent months on the Lawai Kai coastal restoration project and other restorations in the McBryde and Limahuli Gardens on Kaua'i, as well as at Kahanu Gardens on Maui



## Providing a home for *Pritchardia aylmer-robinsonii*

NTBG draws from all available scientific sources in choosing the right plants for its ecological restorations. If a native plant is growing already on the site to be restored, or nearby in similar habitats, it may be included in the project. But sometimes, less direct clues must be employed, especially in highly degraded sites. Then botanists and ecologists at NTBG may employ oral and written histories or information from the pollen, seeds, and fossil leaves that may occur in adjacent paleoecological sites.

The case of Hawaii's endemic loulou palms (*Pritchardia* spp.) are a good example. Limahuli still has an endemic palm, *P. limahuliensis*. But at Lawai Kai and throughout Kaua'i's south coast, no loulou palms have survived in the wild to modern times. Yet thousands of fossil seeds from the sediments of Makauwahi Cave show that these stately native palms were a key

element in coastal plant communities throughout the millennia leading up to human settlement (Burney *et al.*, 2001, *Ecological Monographs* 71:615-641). Most of these fossils are an unusually small, spherical type of *Pritchardia* seed unlike that of most Kaua'i species of the genus. One exception is *P. napaliensis*, which grows on steep wet slopes along the island's western Napali Coast, a very different habitat from the low, sandy, seasonally dry south coast.

*P. napaliensis* has close cousins on other islands that are clearly dry-adapted. The most common of these is *P. remota*, on the distant island of Nihoa in the Northwestern Hawaiian Islands chain. Much closer at hand is *P. aylmer-robinsonii*, a stately palm endemic to the adjacent island of Ni'i'hau, a few miles offshore from Kaua'i's south coast, a species that is nearly extinct in the wild. Botanists believe there are only two mature specimens remaining on Ni'i'hau. Although species from off-island would not normally be used in NTBG restorations, staff at NTBG have opted to use this rare species in their south shore restorations, as it is adapted to

dry lowland conditions, has no current opportunity for restoration on its home island, and may well be a species formerly found in adjacent coastal forests of Kaua'i, or the closest living relative of one that did. In any case, the decision has paid off, as more than 30 large specimens of *P. aylmer-robinsonii* are now thriving and growing rapidly in NTBG restorations at Lawai Kai in the Allerton Gardens and the Makauwahi Cave Reserve, a joint project with Grove Farm, Inc.



*The very rare endemic Loulu palm, Pritchardia aylmer-robinsonii, thrives in NTBG's restoration sites on Kaua'i's south coast. These rapidly growing specimens are inside the limestone sinkhole at Makauwahi Cave, a joint project with landowner Grove Farm, Inc. Sediments excavated here by NTBG staff and volunteers yielded thousands of seeds identical to those of this stately palm.*



# Sustaining biodiversity on Captain Corelli's Island – Cephalonia, Ionian Islands, Greece

Right: Steps through *phrygana* in the garden. Existing plants were supplemented with new species.



Greece is well known for its rich and diverse flora; around 6,000 species grace the varied but often mountainous landscape of this relatively small and physically isolated country. Another reason for the high level of biodiversity is the presence of almost 3,000 islands dotting the seas surrounding the long and dramatic Greek coastline. Crete is especially important as a centre of endemism; less well known for their flora are the Ionian Islands, situated to the west of Greece. With well over one metre of winter rainfall each year, plant growth is verdant when compared to the islands of the Aegean. Though Cephalonia is considerably lower in population density than the most prosperous of the group, Corfu, it is the largest of the Ionian Islands. It also has the highest mountain of the archipelagos, Mount Ainos, a National Park since 1962. With its Grecian Fir forest (*Abies cephalonica* – first identified on the island), it darkly looms above the island's activities at a height of 1,627 metres, dominating nearly every vista. Settlements concentrate around the coastal plains leaving the mountainous interior deserted. Located in an area of significant seismic activity, much of the infrastructure of the island was destroyed during the massive earthquake of 1953; as a result the depopulation that began with the collapse of the Ionian currant trade in the 19th century accelerated. Cephalonia is nowadays best known as the setting for Louis de Berniere's novel *Captain Corelli's Mandolin*.



Inevitably tourism has increased in recent years, bringing with it an influx of population, adding to the pressures on fragile marine and coastal natural resources.

Just outside the main town of Argostoli, on a lowish hillside overlooking the harbour, lies Cephalaria Botanica. This small garden of botanical interest started its journey with the new millennium and is the brainchild of a non-profit making organisation, the Focas-Cosmetatos Foundation. The aim is to create a garden of native flora which provides a location for the Foundation's existing environmental education programmes, as well as offering a local recreational activity and sustainable tourist attraction. East facing, the 2 acre site was formerly an olive grove but had long been abandoned when work on the project began. A massive fire moved through the area about 20 years ago, but the olives, though blackened and in some cases destroyed, mostly survived and now offer welcome shade. The olive grove fell into disuse after the fire, and the creators of the garden faced a veritable jungle as they set out on their task to sculpt a garden from the gently sloping hillside. The site is a gem; set around a gully, the landscape creates a bowl-like valley of peace and tranquillity surrounded by ridges of Kermes Oak (*Quercus*

*coccifera*). The land is terraced with 200 year old stone retaining walls - many are remarkably intact considering they have survived more than a few earthquakes.

During the period of abandonment, many *maquis* and *phrygana* plants colonised the site, and these communities have been enriched and enhanced with appropriate species. Aggressive plants were cleared (*Rubus fruticosus*, *Smilax aspersa*), leaving only representatives, and dominant species (notably *Spartium junceum* and *Sarcopoterium spinosum*) were reduced to make way for the introduction of a greater diversity. Amongst others, *Euphorbia dendroides*, *Laurus nobilis*, *Ceratonia siliqua*, *Myrtus communis*, *Arbutus unedo*, *Rhamnus alaternus*, *Erica arborea*, and *Cupressus sempervirens* were planted into the *maquis* community, while species of *Cistus*, *Thymus*, *Salvia*, *Teucrium* and *Lavandula* were introduced into the *phrygana*. Plenty of species present on the site were real assets: *Cyclamen hederifolium* and *Iris unguicularis* are worthy of special mention, colonies of each providing beautiful displays in autumn. Both re-appeared after several years of dormancy when grasses over one metre high were cleared and subsequently kept low. A number of orchids also occur naturally.

The project plans to increase its role in environmental education and eventually in conservation activities. For now, its focus is on increasing awareness of the ecological vulnerability of islands and the pressures that result from economic development. In common with islands around the world, the richness of biodiversity on Cephalonia (over 1,300 species recorded to date) is matched by its fragility. Rather than be presented as a hindrance to development, biodiversity should be seen as an asset to the island not only in terms of wildlife but also economy. Threats to island ecosystems have direct and indirect consequences on whole social and economic systems. Several initiatives are being developed to help islands not just survive but thrive, in a sustainable way (see introduction to this issue).

Isolation is frequently the biggest problems, and in view of this, Cephalonia Botanica is keen to develop links with other environmental organisations on Mediterranean islands facing similar challenges, or to develop a forum where ideas, experience and even people could be exchanged.

**For further information contact:**  
**Winston Woodward**  
**Cephalonia Botanica**  
**Focas Cosmetatos Foundation**  
**1 P. Vallianos**  
**Argostoli 28100**  
**Cephalonia**  
**Greece**  
**Tel: + 30 26710 26595**  
**E-mail: ipfc@hol.gr**

Left: Educational activities in the garden. The Foundation runs education days once or twice a week.

Below: *Viola cephalonica* endemic on Mount Ainos



**Authors:** Steve Waldren,  
Naomi Kingston, Noeleen Smyth,  
Jay Warren and Carol Warren

# Integrated plant conservation on Pitcairn Island, south-central Pacific Ocean

Right:  
Native forest in  
McCoy's Valley,  
towards the  
south west of  
the island  
showing the  
canopy trees  
with decumbent  
stems  
(*Metrosideros  
collina*), and a  
rich fern layer  
on the forest  
floor. Several  
individuals of  
the critically  
endangered  
*Coprosma  
benefica* grow  
in this location,  
and an  
unnamed  
*Myrsine* was  
discovered in  
this valley in  
2003 which was  
previously  
considered  
extinct.



Pitcairn Island is a small, isolated island at the eastern extremity of the main group of Polynesian islands, roughly half way between New Zealand and South America and just south of the Tropic of Capricorn. The research interest of Trinity College, Dublin (TCD) in the island began in 1991 during the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands, which focussed its attention mainly on 'nearby' Henderson Island (a World Heritage Site) and two atolls Oeno and Ducie. During this expedition it became apparent that the main conservation issues with the flora of these islands was on Pitcairn itself. As a U.K. Overseas Territory governed from the British High Commission in New Zealand, the responsibility for biodiversity conservation on the island

rests with the UK Government. Accordingly, TCD and the Irish National Parks and Wildlife Service (NPWS) secured funding from the U.K. Foreign & Commonwealth Office in 1997 to examine in detail the floristics, vegetation communities and conservation status of the native flora.

The 1997 visit to the island provided a more complete floristic inventory than was previously possible, adding 12 new records of presumed native species to bring the total native flora to 81 taxa, of which 10 are considered endemic. Vegetation communities were described and mapped, and the conservation status of native species assessed, including assessments of the major threats, population size and demographic structure for certain taxa

considered to be most at risk. In some cases these data were backed up with a molecular assessment of genetic diversity. Therefore, a large amount of baseline data was provided which facilitated prioritisation of future conservation activities. The main threats to the native species were identified as those posed by invasive non-native plants, by critically small population size or distribution, by habitat loss, and by erosion. The main invasive species causing problems are *Syzygium jambos*, introduced originally for fuel wood, and *Lantana camara*; both are well known as invasive species elsewhere. Several native species were found to exist in either very restricted areas, such as *Lastreopsis* aff. *pacifica* where all but one individual occurred in a colony occupying an area of 20 x 60 m<sup>2</sup>, or occurred in very low numbers, such as the endemic *Coprosma benefica*, where only 12 individuals were recorded. Only one male plant of the dioecious *C. benefica* was found, though the sex of several individuals could not be determined. The vulnerability of species with such low numbers was made evident when the largest specimen of *C. benefica* blew over in a storm during a visit. The endemic *Abutilon pitcairnense* and *Myrsine* sp. previously recorded from the island could not be located on this visit.

Following the 1991 expedition, recommendations were made that a Conservation Officer be funded as a





Far left: Pitcairn Islanders and Noeleen Smyth in the island nursery

Left: *Lastreopsis* aff. *pacifica*, known from only two locations on Pitcairn

local government position, and this was achieved in 1997 when Jay Warren was appointed to the post. Jay also received training in practical plant conservation by attending a course in the U.K. in 1999 on 'The Cultivation and Conservation of Threatened Plant Species' at the Royal Botanic Gardens, Kew, U.K, through the U.K. Darwin Initiative aimed at U.K. Overseas Territories.

The U.K. Foreign & Commonwealth Office provided funding in 2003 to investigate methods to remove *Syzygium jambos* and reinstate native forest species, while minimising the potential effects of soil erosion. At the same time, Fauna and Flora International provided funding to undertake recovery work on critically endangered plants, and the Irish Research Council for Science and

Technology provided a research fellowship for Noeleen Smyth. Very recently, the Stanley Smith Horticultural Trust has provided a grant to improve the horticultural capacity of the island nursery.

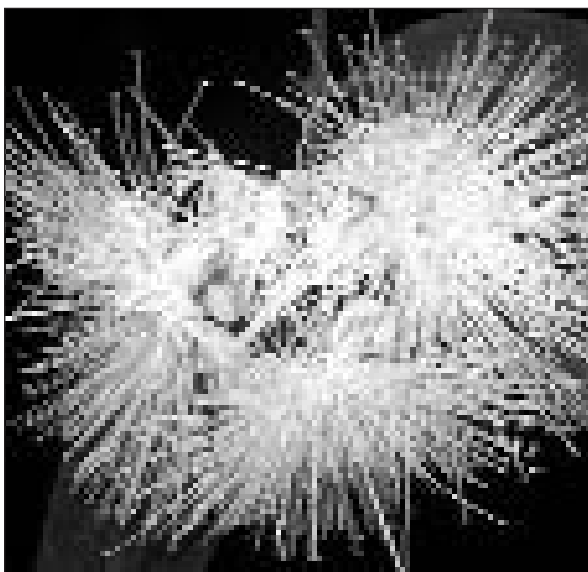
In the meantime, a specimen of the *Abutilon* had been had relocated by Carol Warren, and it was successfully propagated by Carol and Jay from cuttings, proudly displayed to Noeleen and Steve when they visited in July 2003; a cutting is now also growing strongly at Trinity College Botanic Garden, and some self-pollinated seedlings have already been planted out on Pitcairn. A trial translocation of the endemic giant fern *Angiopteris chauliodonta*, undertaken during the 1997 visit, was successful, with 26 young plants established in Jack Willems Valley from 40 transplanted

stipules (fleshy outgrowths of the stipe base, containing an axillary bud). A young plant of a *Myrsine* species was discovered in McCoy's Valley, and two plants have been raised from cuttings at Trinity College Botanic Garden. Molecular studies will determine whether this taxon differs from *M. hosakae*, considered endemic to nearby Henderson Island.

Perhaps the most exciting event was the construction and subsequent development of the island nursery, which is providing a facility to propagate both threatened native plants and plants that are of economic benefit to the islanders. For example, there is a plan to introduce a range of avocado cultivars grafted onto standard stocks, which will greatly increase the avocado season on the island. Noeleen's practical horticultural

Far left: Inflorescence of *Syzygium jambos*: this species was originally introduced for fuelwood, but has subsequently invaded degraded areas of cultivation and now forms a dense thicket over much of the northern side of the island.

Left: Jay Warren and Noeleen Smyth examine a young *Cyclophyllum barbatum* transplanted into a plot cleared of *Syzygium jambos*, which can be seen as a dense thicket in the background.



Right: Noeleen Smyth surveys *Lastreopsis* aff. *pacifica*, known from only two locations on Pitcairn; the 2003 survey showed an increase in numbers since the initial survey in 1997, perhaps suggesting that this taxon is a relatively recent colonist. Pitcairn plants of this taxon are very glandular and have minute, caducous indusia; they may merit taxonomic recognition, and plants grown ex situ at Trinity College will aid taxonomic studies.



training will be put to use in training islanders with grafting techniques. The nursery is also being used to raise stock for planting into experimental plots cleared of *Syzygium*, as well as propagation of critically threatened species, such as *Coprosma* and *Abutilon*. A series of 20 plots have so far been surveyed, and these are being cleared of *Syzygium* as stock for replanting is propagated and grown on. Almost the whole community of the island is working with Noeleen on the plot survey, clearance and propagation, providing a useful source of local income as well as undertaking practical conservation and emphasising the importance of local conservation action within the community.

A strategy for the recovery of critically endangered species have been devised which involves firstly securing the existing genepool by vegetative

propagation, followed by an assessment of genetic variation using AFLP markers, and then controlled breeding to try and maximise diversity. For instance, *Abutilon*, seedlings from selfed seed have been raised and the next step will be to characterise them genetically before selective crossing from the most dissimilar genotypes. Ultimately this work might include a study of the relative effects of inbreeding and outbreeding depression. Many problems remain to be studied, not least the taxonomic identity of taxa such as the *Myrsine* and *Lastreopsis*. Several of the *Coprosma* surveyed in 1997 could not be refound in 2003; no trace remained of the largest plant that blew over in 1997, and the solitary male from that time had recently died. However several other specimens were located and, intriguingly some plants that were 'female' in 1997 now appeared to be

exclusively 'male'. Molecular markers will again be used to confirm or refute whether the individuals that have been relocated are the same.

Clearly, there is still much to learn, including the most effective means of invasive species control. But so far the team are extremely optimistic about the approach taken, which involves a genuine partnership between the local community with their practical skills, and the baseline information that the scientific team from Dublin can provide. Many activities undertaken over the past 13 years make contributions towards the Global Strategy for Plant Conservation, and hopefully it will be both possible to set local targets for Pitcairn, and to achieve these by 2010. By working together, a real synergistic contribution to practical plant conservation on the island can be made and the approach taken on Pitcairn may serve as a model for conservation on other islands.

**Steve Waldren**  
Trinity College Botanic Garden,  
Palmerston Park, Dartry, Dublin 6,  
Ireland  
Tel: +353 (0)1 497 2070  
Fax: +353 (0)1 608 1147  
E-mail: [swaldren@tcd.ie](mailto:swaldren@tcd.ie)  
Internet: <http://www.tcd.ie/Botany/garden.html>

**Naomi Kingston**  
National Parks and Wildlife  
Service, Department of  
Environment and Local  
Government, 7 Ely Place, Dublin 2,  
Ireland

**Noeleen Smyth**  
Department of Botany, Trinity  
College, Dublin 2, Ireland

**Jay Warren and Carol Warren**  
Pitcairn Island, south-central  
Pacific Ocean

**Authors:** M. M. H. Kristensen,  
J. Damgaard, J. Find and P. Krogstrup

# Micropropagation of Bois papaye, *Badula balfouriana*; a critically endangered plant, endemic to Rodrigues, Mascarene Island, western Indian Ocean

*Badula balfouriana* (Kuntze) Mez., Bois papaye, is a small, heterophyllous tree of the Myrsinaceae family, endemic to Rodrigues, a small island of 109 km<sup>2</sup> located 574 km east off Mauritius and 1,450 km to the east of Madagascar. Rodrigues, Mauritius and Réunion make up the Mascarene Islands in the western Indian Ocean. A leaf and bark decoction is used in traditional medicine to relieve teething problems in infants and young children (Gurib-Fakim & Brendler, 2004). Flowering and fruiting is very irregular (Strahm, 1989) and there are currently only two known adults and seven other individuals growing in the wild on Rodrigues. It is endangered (Walter & Gillett, 1998) or possibly critically endangered (Pers comm. Wendy Strahm and John Mauremootoo).

Measures have been taken to conserve this species in its natural habitat. Ten to twelve individuals, grown from seed or propagated by cuttings, have been planted in the upland Grande Montagne, one of the remnants of the Rodriguan upland native forest, by the Mauritian Wildlife Foundation in collaboration with the Ministry for Rodrigues Forestry Service (<http://www.mauritian-wildlife.org/>).

An individual collected as a cutting in 1982 on the slopes of Mont Cimetière by Jean-Yves Lesouef is in cultivation

in the Conservatoire Botanique National de Brest, France. Four new plants were produced by cuttings from the original plant in 2000. Neither the oldest plant (1.5 m tall) nor the younger (60-80 cm tall) have flowered.

*B. balfouriana* has been in cultivation at the Botanic Garden in Copenhagen, Denmark since 1985. Three plants were grown from seed collected by the botanist Karen Thingsgaard in 1985 and 1987, on the slopes of Grande Montagne. One was subsequently lost and neither of the two remaining plants have produced seeds. The taller plant is

now about 3 m high and has flowered twice, but did not produce any fruits. In addition an individual produced by a cutting in Brest was sent to Copenhagen in 2004 and a micropropagated plant of one of the two Copenhagen clones was sent to Brest.

The status of *B. balfouriana* as an endangered plant prompted us to develop a simple and rapid micropropagation system and a method for transferring tissue culture plants to normal growth conditions in our greenhouse.



Left:  
Establishment  
of *Badula  
balfouriana*  
cultures from  
shoot tips.

Right:  
A total of 150  
plants in soil  
were produced.

Work began July 1994, but due to heavy contamination problems, and the scarcity of plant material, the first sterile explants were not obtained until 1996. Shoot tips were cultured on a modified Woody Plant Medium (WPM) containing 5 µM benzyl-6-aminopurine (BAP), a cytokinin growth regulator, alternating with culture on a similar medium but without BAP, produced axillary shoots, with a yield of 6-8 shoots per explant after 12-14 weeks in culture. Rooting was achieved on a modified WPM with varying concentrations of sucrose. The highest



Right:  
Flowering of  
*Badula  
balfouriana* in  
the greenhouse:  
the plant was  
grown from  
seed collected  
in Rodrigues.  
Adult plants  
have broader  
leaves  
compared to  
juvenile plants.



number of roots per explant was obtained on medium with 40g/l sucrose. A total of 150 plants were transferred to the greenhouse and appeared phenotypically uniform and similar to the original seed plant.

The micropropagation method reported here makes it possible to produce a large number of plants in an all-year round process without seasonal dependency. These plants may be used in seed orchards, for cuttings and ultimately introduced into the wild.

However, micropropagation is expensive due to the costly equipment and the trained technical staff who are needed to perform the techniques, Micropropagation may lead to the formation of loose, friable and unorganised, amorphous tissue (callus) which is often associated with genetic alterations, e.g. somaclonal variation.

The reported method, however did not include callus formation and plantlets appeared phenotypically normal and uniform as compared to the donor plant. Nevertheless DNA fingerprint testing would be the ultimate method to test whether the produced plants are genetically identical to the donor plant. Further, micropropagation, like grafting and cuttings, is a clonal process which may potentially narrow the genetic base. Therefore, it is

important to plant several clones that originate from different parent trees with as diverse genetic background as possible.

Taking these factors into consideration, micropropagation offers supplementary conservation possibilities which have the potential to support in situ protection strategies of *B. balfouriana* and other related species, which have a limited reproductive capacity and exist in threatened habitats.

**Acknowledgement** The authors would like to thank Wendy Strahm of IUCN Plants Officer and John Mauremootoo of Mauritian Wildlife Foundation for useful information on the conservation status of *Badula balfouriana* and Cherry Nielsen and Dorte Gurskov for their excellent technical work.

## References

- ➔ Gurib-Fakim, A. & Brendler, T., 2004. *Medicinal and aromatic plants of Indian Ocean Islands: Madagascar, Comoros, Seychelles and Mascarenes*. Medpharm Scientific Publishers, Stuttgart, Germany.
- ➔ Strahm, W., 1989. *Plant Red Data Book Book for Rodrigues*, Koeltz Scientific Books, Königstein, Germany.
- ➔ Walter, K. and Gillett, H. 1998. *1997 IUCN Red List of threatened plants*, IUCN – The World Conservation Union, Gland, Switzerland and Cambridge, U.K.

**M. M. H. Kristensen, J. Find and P. Krogstrup**  
**Botanic Garden, Plant Cell & Tissue Culture Laboratory,**  
**University of Copenhagen, Øster Farimagsgade 2D, DK 1353 Copenhagen K., Denmark.**  
**Tel: +45 3532 2222**  
**Fax: +45 3532 2221**  
**E-mail: MichelK@BOT.KU.DK**  
**Internet: <http://www.botanic-garden.ku.dk/eng/>**

**J. Damgaard**  
**Botanic Garden, Living Collections,**  
**Cacti- and Succulents.**

# Short Communications

## CITES News

2004 has been a busy and productive year for CITES. The thirteenth Conference of the Parties (COP13) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was convened in Bangkok, Thailand from 2-14 October 2004. Key plant issues included the listing of all species of the Indo-Malaysian tree genus *Gonystylus* (Ramin) on CITES Appendix II, the delisting from Appendix II of a range of orchid hybrids (from the genera *Cymbidium*, *Vanda*, *Dendrobium* and *Phalaenopsis*), the listing of medicinal Agarwood-producing species of the genera *Aquilaria* and *Gyrinops* and the addition of the succulent, *Hoodia*, to Appendix II. Appendix II allows for both wild and artificially propagated taxa to be traded subject to permitting regulations. Ramin is in high volume trade from Asia to Europe and the USA. It is traded as wooden mouldings, picture frames, Venetian blinds, components for gardening and household tools (e.g. trowel and broom handles) and snooker cues. A number of plant species were delisted from CITES control including a wide range of *Euphorbia* cultivars, thus removing the need to permit millions of artificially propagated plants per year. This trade has no impact on wild populations and is a positive move for conservation. It also releases scarce CITES resources to be targeted at non-sustainable trade. The next COP is scheduled for April 2007 in The Netherlands.

Discussions also centred on cooperation between CITES and other organisations, including the Convention on Biological Diversity (CBD), and the incorporation of the sustainable use concept into the CITES non-detriment finding process. The final outcome of these discussions centred on reviewing the findings and recommendations of the Vilm Workshop on CITES-CBD cooperation and synergies, held in Germany from 20-24 April 2004,



identifying priority actions from this workshop in order to meet World Summit on Sustainable Development (WSSD) 2010 targets, and revision of the CITES Work Plan for Implementation of Joint Activities between CITES and CBD before CoP14. The Parties were urged to make use of the CBD's Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity, participate in CBD work and provide the CITES Secretariat with case studies of how these Principles can be used in the trade of Appendix II species.

Enforcement is an important element for implementing CITES and it received considerable attention at COP13 with Thailand's willingness to take a lead in the formation of a new south east Asian regional law enforcement network to combat nature crimes. The ten Environment Ministers of the Association of Southeast Asian nations (ASEAN) agreed to formulate a regional action plan on trade in wild fauna and flora.

In September 2004, two new CITES User Guides were published. 'CITES and Plants: A User's Guide' is a 'user friendly' tool for training those who wish to know about CITES and plants. 'CITES and Succulents: A User's Guide'



provide an introduction to the succulent plants on CITES.' The Guides were produced by the Conventions and Policy Section (CAPS) of the Royal Botanic Gardens, Kew, UK and were funded by the UK CITES Management Authority, the Department for Environment, Food and Rural Affairs (Defra). They were launched at the CITES COP in Bangkok by the UK Minister of State for Environment and Agri-Environment, Elliot Morley and are produced in English, French and Spanish. Both User Guides contain speaker notes, a bibliography, a list of resources and a CD with Powerpoint presentations which can be tailored to the individual users needs.

For more information check the following websites:  
CITES - <http://www.cites.org>  
EU Wildlife Trade Regulations - <http://www.eu-wildlifetrade.org>  
Traffic - <http://www.traffic.org>

**Madeleine Groves, Lucy Ellerbeck & Noel McGough,**  
Conventions & Policy Section,  
Royal Botanic Gardens, Kew,  
Richmond, Surrey TW9 3AE, U.K.  
Tel: +44 (0)20 8332 5723,  
Fax: +44 (0)20 8332 5757,  
E-mail: [M.Groves@rbgkew.org.uk](mailto:M.Groves@rbgkew.org.uk)

## Emergency decree banning deforestation in Argentina

Argentina has lost 70 per cent of its native forests in the last 88 years. In the Official National Census of 1914, 1,060,000 km<sup>2</sup> were covered with native forests. In 1970, 600,000 km<sup>2</sup> remained. At the present time, according to the recent National Inventory of Native Forests of the Argentine Republic (Argentine Secretary of Environment and Sustainable Development, 2002), only 330,000 km<sup>2</sup> still exist. In 1914, 38 per cent of the country had native forests; in 1970 22 per cent; now it has less than 12 per cent. These figures are striking and the cause is simple. There has been unregulated tree felling mainly for the expansion of agriculture with no support for farmers that respect sustainable development. Planning is essential to support sustainable production, and conservation of natural areas. There needs to be regulations for management of forests and natural reserves to preserve ecosystems and protected species.

Deforestation not only destroys biodiversity, but also important rural communities, cultures and ancient crops, and above all, unemployment has grown greatly leading to rural depopulation. Native forests are Argentina's primary wealth. Plant and animal biodiversity are a rich genetic, environmental and economic resource. Among other precious benefits, forests prevent soil erosion, floods, droughts, climate changes, and most importantly, shelters biodiversity. The National Inventory of Native Forests (2002) also warns that deforestation may lead to the loss of 40 per cent of plant and animal species of the country. Many trees are threatened with extinction, among others *Araucaria angustifolia* (Pino Paraná) in the province of Misiones, *Tabebuia* spp. (Lapachos) and *Amburana cearensis* (Palo trébol) in the NW jungles of the Yungas; *Bulnesia sarmientoi* (Palo santo) and *Schinopsis* spp. (Quebrachos colorados) in Chaco; *Fitzroya cupressoides* (Alerce), *Austrocedrus chilensis* (Ciprés de la cordillera) and *Araucaria araucana* (Pehuén) in the South. Deforestation has been

condemned in the media. For instance, Greenpeace protested that natural reserves were being sold to grow soybean in the province of Salta (transgenic soybean production is often not used for human nourishment in Argentina, but to feed cattle in developed countries). The most severely damaged zones are in the NW and NE of the country, as well as in the Chaco forests. The deforested areas are abandoned or become deserts, once the land is degraded.

The province of Entre Ríos is one of the most severely affected by water erosion and deforestation. The Official Native Forest Census of 1914 registered 4,930,000 ha of forests (56 per cent of its total area). According to another study requested by the government in 1997, Entre Ríos had 1,995,873 ha covered with native forests (33 per cent of its total area). In 2003, the provincial government asked the Faculty of Agricultural Sciences of the Entre Ríos National University in collaboration with the Teledetection and Image Processing Group of the Faculty and the Oro Verde Botanic Garden to identify the remaining areas with native forests. This report showed that in the last seven years over 600,000 ha disappeared in the province. Only 1,360,056 ha remained at the beginning of 2003 and many more are thought to have been deforested. As a result of these conclusions the government of Entre Ríos sanctioned an emergency decree banning deforestation in all its territory

establishing severe penalties for its infringement (The Provincial Emergency Decree No 4519/03 (Decreto de Emergencia Ambiental). The present government abolished this decree, but a legal appeal was presented by many ecological groups and won. This led to an historical agreement between the provincial government of Entre Ríos, non-governmental organizations and agricultural entities to establish regulations in accordance with sustainable development that has no precedent in the country (Paraná, 26 de agosto de 2004). The Oro Verde Botanic Garden was asked to present a detailed report to give reasons for preserving native forests which was used in evidence by the examining magistrates.

The future of these new announcements is perhaps the most unknown question. There were 106 million hectares of native forests in the country at the beginning of last century. Today there are 33 million hectares. In between there are only 88 years. It is clear that there is no time to waste.

**Juan de Dios Muñoz,**  
**Jardín Botánico Oro Verde,**  
**Facultad de Ciencias**  
**Agropecuarias, Universidad**  
**Nacional de Entre Ríos, Casilla de**  
**Correo 24, 3100 Paraná, Entre**  
**Ríos, Argentina.**  
**Tel: +54 43 975075,**  
**Fax: +54 43 975096,**  
**E-mail: juandediosm@infovia.com.ar**

Right: Native woodland of Entre Ríos in the Oro Verde Botanic Garden (Photo: Douglas Gibbs)



# Book Notices

R.D. Smith, J.B. Dickie, S.H. Linington, H.W. Pritchard and R.J. Probert (eds), 2003  
*Seed conservation – turning science into practice*

Kew: Royal Botanic Gardens 1,023 pp.  
ISBN 1 84246 052 8 Price: £59.95 (\$107.90)  
plus postage £5.50 U.K., £11.00 Western Europe, £20.90 Rest of Europe, £17.60 U.S.A., £20.90 Rest of world.  
To order a copy contact KewBooks.com, c/o Summerfield Books, Main Street, Brough, Cumbria, CA17 4AX, U.K.  
Tel: +44 (0)17683 41577,  
Fax: +44 (0)17683 41687,  
Internet: kewbooks.com

This book is the outcome of a workshop in 2001 hosted at Wakehurst Place by the Millennium Seed Bank Project, and reflects international collaboration on the seed conservation of wild plant species. The 56 chapters are divided into 3 sections: planning and collecting, seed processing and testing and seed storage and utilisation.

The planning and collecting section has chapters on the applications of Geographical Information Systems, using genetic data (to help guide decisions about sampling), and seed maturity (when to collect seeds from plants) with case studies on forage grasses and legumes, collecting in Namibia, South Africa and Burkina Faso and use of a database in Mexico for targeting and managing biological collections. The seed processing and testing section has chapters on the significance of seed and fruit structure in seed conservation, general principles of seed processing for storage, seed drying methods, databases, viability testing and dormancy-breaking treatments. The last section, seed storage and utilisation includes chapters on the principles of seed bank design for wild germplasm, optimal long-term storage conditions and case studies that provide outlines on aspects of seed conservation in Ethiopia, Spain, Greece, U.S.A. The Netherlands, the Nordic countries, Jordan, India and Morocco. The final chapter looks at the implications of three international initiatives, the Global Strategy for Plant Conservation (GSPC), the adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the Global Conservation Trust (Johannesburg, South Africa, 2002) on the future of seed banks, both collectively and individually.

This book is full of practical articles on current seed banking experience and is essential base-line information for all seed banking facilities particularly those developing new projects.

Mike Maunder, Colin Clubbe, Clare Hankamer and Madeline Groves (eds), 2002  
*Plant Conservation in the Tropics - Perspectives and Practice*

Royal Botanic Gardens, Kew, U.K. 628 pp.  
ISBN 1 84246 014 5 (paperback)  
Price: £29.95 plus postage £3.50 U.K., £5.50 Europe, £9.00 North America and rest of world.  
To order a copy contact KewBooks.com, c/o Summerfield Books, Main Street, Brough, Cumbria, CA17 4AX, U.K.  
Tel: +44 (0)17683 41577,  
Fax: +44 (0)17683 41687,  
Internet: kewbooks.com

These case studies drawn from Africa, the Galapagos Islands, Mauritius, Seychelles, Trinidad, Central and South America, SE Asia and Australia on plant conservation in the tropics are an outcome of the Darwin Plant Conservation Techniques course for East Africa, a joint Royal Botanic Gardens, Kew and National Museums of Kenya project. It provides the tools for national biodiversity action planning; habitat survey; community participation and assessment of sustainable use and the role of horticulture in species recovery and sustainable management.

Longman, K. A. (2003)  
*Tropical Trees: Propagation and Planting Manuals: Volume 2 Raising seedlings of tropical trees*  
Commonwealth Science Council, London, U.K. 118 pp. ISBN: 0 85092 656 4  
Price: £16.00  
Obtain from Commonwealth Secretariat Publications, Marlborough House, Pall Mall, London SW1Y 5HX, U.K.  
Tel: +44 (0)20 77476500,  
Fax: +44 (0)20 7930 0827,  
E-mail: info@commonwealth.int, Internet: <http://publications.thecommonwealth.org/>  
*In English, Spanish and Bahasa Malaysia.*

This is the second of five volumes (although the fourth to appear) in the series *Tropical Trees: Propagation and Planting Manuals*. These manuals have been written by Dr Longman on his retirement after a working life as a forester and university lecturer mainly in West Africa. As earlier volumes on rooting cuttings, growing trees for planting and preparing to plant trees, the information is set out in a conversational style (a question and answer format) with many line drawings. It is spirally-bound with 53 sheets on topics such as why grow tropical trees, sexual reproduction in trees, choosing seed sources which discusses biodiversity and domestication and the assessment of

germination and a list of further resources. The assessment of germination discusses when you would need to assess germination accurately, the different procedures which could be used and how to see which seeds have germinated. This approach will empower staff to make informed decisions on raising seedlings and would be useful for botanic garden staff in the tropics who are developing propagation techniques.

E. Robbrecht and A. Bogaerts (eds), 2004  
*EuroGard III Proceedings - Papers from the Third European Botanic Gardens Congress and the Second European Botanic Gardens Education Congress (BEDUCO II).*  
*Scripta Botanica Belgica* 29. 177 pp.  
ISBN 90 72619 60 9 Price: €24.00  
For copies, contact National Botanic Garden of Belgium, Domein van Bouchout, B-1860 Meise, Belgium. Tel: +32 2 260 09 20,  
Fax: +32 2 270 15 67;  
E-mail: sales@br.fgov.be,  
Internet: www.br.fgov.be

These proceedings have been divided into four sections: the work of botanic gardens, research on living collections, biodiversity and conservation. They provide a valuable resource and permanent record of good practice, models and case studies for botanic gardens to use for enhancing future activities.

T.D. Pennington, C. Reynel and A. Daza, 2004  
*Illustrated Guide to the Trees of Peru*  
DH BOOKS, Sherborne, U.K. 848 pp.  
ISBN 0 953 8134 3 6 Price incl. postage:  
U.K.: £ 45.00, €70.00, Rest of world:  
£50.00/US\$80.00 (surface mail: please enquire rates for airmail. Address for orders: DH BOOKS, The Manse, Chapel Lane, Milborne Port, Sherborne, DT9 5DL, U.K. or Kew website: <http://www.kew.org>

The *Illustrated Guide to the Trees of Peru* is a user-friendly, comprehensive generic account of the Peruvian tree flora. Although designed for Peru, it will also be valuable in other Andean countries, such as Ecuador and Bolivia, which share many of the same tree species. It has family and generic keys to 980 genera, including commonly cultivated and naturalized genera. It is profusely illustrated with line drawings and colour illustrations by Rosemary Wise and about 200 colour photos. As Professor Sir Ghilleen Prance says in the Foreword, this is not just a work based on the extraction of information from the literature but is based on extensive field and herbarium work of the three authors and will be extremely useful for botanic garden libraries.

---

Matthew Jebb and Judith Cheney, 2004  
*Design and display of plant collections*  
PlantNet, U.K. 52 pp.  
For further information, please contact  
Judith Cheney, PlantNet Administrator,  
c/o University Computing Service,  
New Museums Site, Pembroke Street,  
Cambridge, CB2 3QH.  
Tel & Fax: 01223 763901,  
E-mail jc151@cam.ac.uk,  
Internet: www.plantnet.org

This booklet *Design and display of plant collections* is based on a PlantNet (The Plant Collections Network of Britain and Ireland) conference at the Royal Horticultural Society Garden, Rosemoor in April 2002. Current innovations and ideas were explored through eight themes: authenticity and history, natural and ecological, conservation, plants and planting, spectacle and 'wow-factor', seasons and festivals, education, research and self discovery, structures and features. The information is also presented in an innovative way – the themes are reviewed by the authors which are illustrated by notes from the talks and garden visits. The notes cover garden promotion (Peter Thoday), prairie planting (James Hitchmough), family beds (Matthew Jebb), plant community displays (Alasdair Hood) and collection planning at Rosemoor (Christopher Bailes).

---

J.E. Victor, M. Koekemoer, L. Fish, S.J. Smithies and M. Mössner, 2004  
*Herbarium essentials: the southern African herbarium use manual*  
Southern African Botanical Diversity Network Report No. 25  
SABONET, Pretoria, South Africa. 94 pp.  
ISBN 1 919976 01 9  
Copies are available from the Southern African Botanical Diversity Network, c/o National Botanical Institute, Private Bag x101, Pretoria, 0001 South Africa.  
Tel: +27 12 804 3200, Fax: +27 12 804 5979,  
E-mail: sabonetpub@nbi.ac.za,  
Internet: www.sabonet.org

This beautiful and user-friendly book describes types of herbarium collection, plant collecting, pressing and drying, mounting, physical curation, herbarium pests, scientific curation and procedures for setting up a new herbarium. It includes a useful list of references and a comprehensive index. This book will provide helpful techniques and background reading for anyone working in a herbarium not only beginners.

The book is extremely detailed with a wealth of practical experience; it has been developed from notes on herbarium practices and techniques which would have been passed between collectors, mounters and curators and not necessarily written or published. The chapter on scientific curation is very clear; it has a very good page on incorporating new research with a step by step guides on how to evaluate

taxonomic revisions and how to incorporate a taxonomic revision. It gives guidelines on every topic from collecting permits to creating labels and also includes useful tips such as 'Laser printer toner is permanent and is of archival quality. Bubble jet and Deskjet ink is NOT waterproof', '... A basic knowledge of first aid could be life saving...' and 'When using a hand lens, move the object to be viewed, rather than the lens.'

---

J.M.M. Engels and L. Visser (ed), 2003  
*A Guide to Effective Management of Germplasm Collections*  
IPGRI Handbooks for Genebanks No. 6,  
IPGRI, Rome, Italy. 174 pp. ISBN: 92 9043 582 8 Price: US\$ 24  
For further information please contact the International Plant Genetic Resources Institute (IPGRI-HQ), Via dei Tre Denari 472/a, 00057 Maccarese (Fiumicino) Rome, Italy. Tel: +39 06 6118.1,  
Fax: +39 06 61979661,  
E-mail: ipgri@cgiar.org or ipgri-publications@cgiar.org,  
Internet: www.ipgri-cgiar.org/publications  
PDF file available from website.

This handbook is primarily aimed at genebank staff to provide ideas, options and considerations to assist in developing coherent and effective genebank strategies. Chapters cover the context of genebank management, setting objectives for genebanks, considerations for improved conservation and utilization concepts and strategies, genebank management procedures, rationalization of genebank management, economic costs of genebank operations and sharing responsibilities.

The idea is to ensure that genebanks become more useful, better used, and better known in wider society. To that end the Handbook goes beyond a narrow view of genebank management – the preservation of genetic integrity and viability of stored material – to deal with agenda setting, improved use of accessions, economic costs, and how to share responsibilities and collaborate with a wider range of partners. It also includes a series of case studies illustrating how three specific genebanks have addressed these wider concerns.

---

L. Vallee, T. Hogbin, L. Monks, B. Makinson, M. Matthes, and M. Rossetto, 2004  
*Guidelines for the translocation of threatened plants in Australia* 2nd Edn.  
Australian Network for Plant Conservation, Canberra, Australia. 80 pp. ISBN 0975219103. Price: AUD\$22 plus postage and handling of \$5 per copy within Australia.

Order forms available from  
<http://www.anbg.gov.au/anpc/books.html> or contact the ANPC National Office  
Tel: +61 (0)2 6250 9509,  
Fax: +61 (0) 2 6250 9528,  
E-mail anpc@deh.gov.au.  
Internet: www.anbg.gov.au/anpc

Translocation or reintroduction is the deliberate transfer of plants or regenerative plant material from an ex situ collection or natural population to a location in the wild, including existing or new sites or those where the taxon is now locally extinct. However, despite the potential benefits of translocation, there are potential risks associated with the technique and as considerable effort required to implement a translocation programme the Australian Network for Plant Conservation (ANPC) published *Guidelines for the Translocation of Threatened Plants in Australia* in 1997.

The ANPC recognised the need to revise the guidelines as translocation has continued to be used as a conservation tool but with some inappropriate practices. This new edition, reflects advances in scientific practice and the greatly increased practical experience in translocation. In particular, the new guidelines include greater emphasis on evaluating whether translocation is justified and practical, monitoring and evaluation, and involving local communities. The main points are brought together in useful case studies from across Australia. A new format enhances usability and operational sections have convenient checklists to aid those involved in the planning, approval, or implementation of translocation programs.

The ANPC is running a series of workshops on translocation, to familiarise practitioners with the new Guidelines and to help people exchange experiences.

---

Erik Millstone and Tim Lang, 2003  
*The Atlas of Food Who Eats What, Where and Why*  
Earthscan, U.K. 128 pp. ISBN:1853839655 (paperback) Price: £12.99  
Earthscan, 8-12 Camden High Street, London, NW1 0JH, U.K.  
Tel: +44 (0)1903 828 800; website order enquiries +44 (0)1903 828 800,  
Fax: +44 (0)20 7387 8998,  
E-mail: earthinfo@earthscan.co.uk,  
Internet: www.earthscan.co.uk

This atlas follows on from other Earthscan atlases such as those on water and endangered species. The atlas provides double-page spreads of easy to read facts, figures, maps and graphics on over 40 topics on the core issues that affect our food from population and water through farming to trade and food processing, retailing and consumption. The topics include pesticides, agricultural biodiversity, urban and sustainable farming, food miles, staples and organic food and provide useful baseline information.



Please register your contributions to the *International Agenda for Botanic Gardens in Conservation*

## International Agenda for Botanic Gardens in Conservation Registration Form

<b>Name of Institution</b>			
<b>Type of Registration</b>	<b>Formal</b>	Board Resolution or other form of approval from relevant governing bodies (e.g. university authorities, local, regional or national government)	<i>Please Tick</i> <input type="checkbox"/>
	<b>Informal</b>	E.g. by Director/Senior staff.	<input type="checkbox"/>

BGCI would welcome copies of any formal resolution, motion or other form of endorsement.

<b>Name of responsible person</b>			
<b>Position</b>			
<b>Address</b>			
<b>Email</b>		<b>Date of Registration</b>	

### Declaration

This institution welcomes the International Agenda for Botanic Gardens in Conservation as a global framework for the development of institutional policies and programmes in plant conservation for botanic gardens.

Without imposing any obligations or restrictions (legal or otherwise) on the policies or activities of this institution/organisation, we commit ourselves to working to achieve the objectives and targets of the *International Agenda for Botanic Gardens in Conservation*.

<b>Signed</b>		<b>Date</b>	
---------------	--	-------------	--

Please sign and detach this registration form and send it to The Secretary General, Botanic Gardens Conservation International, Descanso House, 199 Kew Road, Richmond, Surrey TW9 3BW, U.K.

Thank you for registering with the *International Agenda for Botanic Gardens in Conservation*.

Please keep a duplicate copy of this form for your records.

# How to join Botanic Gardens Conservation International

The mission of BGCI is to build a world network for plant conservation. It was founded in 1987 and now includes over 525 member institutions in 115 countries, working together to implement the *International Agenda for Botanic Gardens in Conservation* and the new *Global Strategy for Plant Conservation*.

**Institutions** can join BGCI for the following benefits:

- Membership of the worldwide plant conservation network
- Botanic Garden Management Resource Pack (upon joining)\*
- Regular publications:
  - the regular newsletter, *Cuttings*
  - *BGjournal* – an international journal for botanic gardens (2 per year)
  - *Roots* - environmental education review (2 per year)
  - A wide range of new publications
- Invitations to BGCI congresses and discounts on registration fees
- BGCI technical support and advisory services

Institution Membership		£ Stlg	US \$	€ Euros
A	BGCI Patron Institution	5000	8000	7500
B	Institution member (budget more than US\$2,250,000)	600	1000	940
C	Institution member (budget US\$ 1,500,000 - 2,250,000)	440	720	660
D	Institution member (budget US\$ 750,000 - 1,500,000)	300	500	440
E	Institution member (budget US\$ 100,000 - 750,000)	160	250	220
F	Institution member (budget below US\$100,000)*	75	120	110

\*Generally applies to institutions in less developed countries

## Other Membership Categories:

Membership benefits depend on category - see below. These can include:

- Regular publications:
  - the regular newsletter, *Cuttings*
  - *BGjournal* - an international journal for botanic gardens (2 per year)
  - *Roots* - Environmental Education Review (2 per year)
- Invitations to BGCI congress and discounts on registration fees

Corporate Membership		£ Stlg	US \$	€ Euros
G	Corporate Gold Member ( <i>BGjournal</i> , <i>Roots</i> and <i>Cuttings</i> plus more)	5000	8000	7500
H	Corporate Silver Member ( <i>BGjournal</i> , <i>Roots</i> and <i>Cuttings</i> plus more)	1000	1600	1500

Individual Membership		£ Stlg	US \$	€ Euros
J	Conservation donor ( <i>BGjournal</i> , <i>Roots</i> and <i>Cuttings</i> plus more)	160	250	220
K	Associate member ( <i>Cuttings</i> and <i>BGjournal</i> )	35	60	50
L	Associate member ( <i>Cuttings</i> and <i>Roots</i> )	35	60	50
M	Friend ( <i>Cuttings</i> ) available through online subscription only ( <a href="http://www.bgci.org">www.bgci.org</a> )	10	15	15

\*Contents of the Botanic Garden Management Resource Pack: *The Darwin Technical Manual for Botanic Gardens*, *A Handbook for Botanic Gardens on the Reintroduction of Plants to the Wild*, *A CITES Manual for botanic gardens*, *BGjournal - an international journal for botanic gardens (2 past issues)*, *Roots - environmental education review (2 past issues)*, *The International Agenda for Botanic Gardens in Conservation*, *Global Strategy for Plant Conservation*, *Environmental Education in Botanic Gardens*, *BG-Recorder (a computer software package for plant records)*.

Payment may be made by cheque payable to Botanic Gardens Conservation International, or online at [www.bgci.org](http://www.bgci.org) or by VISA/Mastercard sent to BGCI, Descanso House, 199 Kew Road, Richmond, Surrey, TW9 3BW, U.K or Fax: +44 (0) 20 8332 5956.

I wish to apply for membership of Botanic Gardens Conservation International.

Name .....  
 Telephone .....  
 Address .....  
 .....  
 Fax .....  
 E-mail .....  
 Internet site .....

Membership category ..... Annual rate .....  
 VISA/Mastercard number ..... Credit card expiry date .....  
 Signature ..... Print name .....

I would like to make a donation to BGCI. Amount .....

Please clearly state your name (or the name of your institution) on all documentation. Please contact [info@bgci.org](mailto:info@bgci.org) for further information.

# Botanic Gardens Conservation International (BGCI)

## PUBLICATIONS LIST 2004

TITLE	PRICE		POSTAGE		
	Member of BGCI	Non-member of BGCI	U.K. (2nd class)	Europe Economy 7-14 days	Rest of World Standard 14-21 days
<b>POLICY</b>					
<i>Global Strategy for Plant Conservation</i> CBD Secretariat, 2003	Free	Free	£1.00	£1.00/€1.50	£2.00/\$4.00
<i>International Agenda for Botanic Gardens in Conservation</i>	£6.00	£9.00	£1.00	£1.00/€1.50	£2.00
Wyse Jackson & Sutherland (eds, 2000) English, French or Spanish versions	€9.00 \$11.50	€13.50 \$17.00			\$4.00
<b>ACTION PLANS</b>					
<i>Action Plan for Botanic Gardens in the European Union</i>	£4.50	£6.50	£1.00	£1.00/€1.50	£2.00
Cheney et al. (comp & eds, 2000) English or French versions	€7.00 \$8.50	€10.00 \$12.50			\$4.00
<b>MANUALS</b>					
<i>The Darwin Technical Manual for Botanic Gardens</i>	£10.00	£14.00	£2.00	£3.00/€4.50	£5.00
Leadlay & Greene (eds, 1998) English, French or Spanish versions	€14.00 \$19.00	€19.50 26.50			\$9.00
<i>A Handbook for Botanic Gardens on the Reintroduction of Plants to the Wild</i>	£3.50	£5.00	£1.00	£1.00/€1.50	£1.00
Akeroyd & Wyse Jackson (1995)	€5.00 \$6.50	€7.00 \$9.50			\$2.00
<i>A CITES Manual for botanic gardens</i>	£3.50	£5.00	£1.00	£1.00/€1.50	£1.00
Akeroyd, McGough & Wyse Jackson (eds, 1994) English or Spanish versions	€5.00 \$6.50	€7.00 \$9.00			\$2.00
<b>PROCEEDINGS</b>					
<i>European Botanic Gardens - studies in conservation and education</i>	£5.00	£8.00	£1.00	£1.00/€1.50	£2.00
(papers from the Eurogard 2000 Congress) Hobson (ed, 2003) CD-ROM	€7.00 \$9.50	€12.00 \$15.00			\$4.00
<i>Plants, People and Planet Earth - the role of botanic gardens in sustainable living</i> - (5th International Botanic Gardens Conservation Congress) Davis & Scott (comp, 2001) CD-ROM	£5.00	£8.00	£1.00	£1.00/€1.50	£2.00
	€7.00 \$9.50	€12.00 \$15.00			\$4.00
<i>Conservation into the 21st Century</i> (4th International Botanic Gardens Conservation Congress) Touchell et al. (eds, 1997)	£30.00/€45.00/\$57.00 including postage for members or non-members of BGCI				
<i>Botanic Gardens in a Changing World</i> (3rd International Botanic Gardens Conservation Congress) Hobson (ed, 1996) diskette	£5.00	£8.00	£1.00	£1.00/€1.50	£2.00
	€7.00 \$9.50	€12.00 \$15.00			\$4.00
<b>EDUCATION</b>					
<i>Plants for the Planet</i> BGCI, 2005, CD-ROM	£12.00	£18.00	£1.00	£1.00/€1.50	£2.00
	€18.00 \$23.00	€27.00 \$34.00			\$4.00
<i>Environmental Education in Botanic Gardens: Guidelines for developing individual strategies</i> Willison (ed, 1994)	£3.50	£5.00	£1.00	£1.00/€1.50	£1.00
	€5.00 \$6.50	€7.00 \$9.00			\$2.00
<i>Teaching for the 21st Century</i> (3rd International Congress on Education in Botanic Gardens) Hobson & Willison (eds, 2001)	£10.00	£14.00	£2.00	£2.00/€3.00	£3.50
	€14.00 \$19.00	€19.50 \$26.50			\$6.50

### Publication Order Form

Send To: **Botanic Gardens Conservation International**,  
Descanso House, 199 Kew Road, Richmond, Surrey, TW9 3BW, U.K.

Fax: +44 (0)20 8332 5956

Title	Quantity required	Cost per item	Total Cost
Total amount payable: (£/US\$)			

Name ..... Telephone .....

Address ..... Fax .....

..... E-mail .....

..... Membership (Y/N)

VISA/MASTERCARD Number ..... Credit card expiry date .....

Signature ..... Print name .....



**Botanic Gardens  
Conservation International**

Descanso House, 199 Kew Road,  
Richmond, Surrey, TW9 3BW, U.K.

Tel: +44 (0)20 8332 5953  
Fax: +44 (0)20 8332 5956  
E-mail: [info@bgci.org](mailto:info@bgci.org)  
Internet: [www.bgci.org](http://www.bgci.org)



**This publication is supported  
through *Investing in Nature***

**A partnership between BGCI,  
Earthwatch, HSBC and WWF**

*Investing  
in Nature*



Printed on 100% recycled paper

ISSN 0965-2582