A Manual for Developing Conservation Programs

Selections from the Applied Plant Conservation Training Program

A Collaborative Project of

Denver Botanic Gardens and the U.S. Botanic Garden

DENVER BOTANIC GARDENS

UNITED STATES BOTANIC GARDEN

Editors:
Dr. Anna A. Sher
Dr. Janet Wingate

Project Managers:
Cindy L.Taylor
Tad Lusk

Authors:
Jennifer Ceska
Betsy Cheroutes
Celia Curtis
Dr. Christine A. Flanagan
Thomas Grant III
Dan Johnson
Panayoti Kelaidis
Dr. Kathryn Kennedy
Dr. Johnny Randall
Nicola Ripley
Dr. Anna Sher

Design:
Tad Lusk

Published in 2007 by
Denver Botanic Gardens
1005 York Street
Denver, Colorado 80206, U.S.A.
(720) 865-3500
www.botanicgardens.org
www.appliedplantconservation.org

Copy Editing services by Mary C. Eberle, Boulder, Colorado.
Printed by

DENVER BOTANIC GARDENS

UNITED STATES BOTANIC GARDEN

Acknowledgements

Denver Botanic Gardens would like to thank the United States Botanic Garden for their partnership in the creation of the Applied Plant Conservation Training Program and for funding these proceedings. We would also like to thank the Center for Plant Conservation, the State Botanical Garden of Georgia, North Carolina Botanical Garden and the Betty Ford Alpine Gardens for helping to make these proceedings possible.

Foreword

Foreword

By Anna A. Sher, Ph.D.
Director of the Applied Plant Conservation Training Program
Director of Research, Herbaria and Records
Denver Botanic Gardens

This volume represents a small portion of the Applied Plant Conservation ("APC") Training Program, a two-week workshop funded by the United States Botanic Gardens and held at Denver Botanic Gardens (DBG) in the summers of 2005 and 2006. It is not a proceedings in the strict sense, as it includes only some of the authors who presented and is not a literal representation of the presentations made. Rather, the intent here is to capture some of the key aspects of this celebrated project to assist small and medium-sized botanic gardens and like institutions in their efforts to develop, fund and interpret their plant conservation programs. We have also included case studies from DBG, Betty Ford Alpine Garden and the North Carolina Botanical Garden to represent different approaches and emphases. This text does not cover research methods or scientific approaches to plant conservation, both topics that were presented in some depth during the first week of the APC program by the Center for Plant Conservation (CPC). At the time of this printing, the CPC intends to offer that portion of the program again in the future and may produce a manual of their own. It is important to note that the purpose of any proceedings or manual from this program cannot (and is not intended to) duplicate the experience of attending it.

Participants and presenters in the APC program were from diverse institutions and locations. Speakers in the second week of the APC program featured the expertise at Denver Botanic Gardens (12 DBG speakers) and leading professionals from botanic gardens and organizations (25 non-DBG), including the Smithsonian Institution, Botanic Gardens Conservation International, the Betty Ford Alpine Garden, the University of Washington, Bureau of Land Management, the University of Denver and the CPC. Participants were from around the country and the world; countries represented included Canada, Mexico, United Kingdom, Turkey, Indonesia, Mexico and Puerto Rico. Of the American participants, 20 states were represented, including Hawaii and Alaska. Organizations included nine botanic gardens, 12 colleges or universities, eight federal or state agencies and three other nonprofits (Butterfly Pavilion in Denver, Zoo Atlanta and City of Tulsa Zoo). The background of the audience ranged from undergraduate and graduate students to working professionals with years of experience in the field. Also in attendance were 12 APC Interns, who were selected out of a pool of more than 80 applicants, indicating a high interest in programs of this type. Interns attended both weeks of the seminar plus seven to nine additional weeks of research, fieldwork and independent study.

Participants rated the APC program with top marks both years. Some of the comments from the evaluations included the following:

"Best Professional (or otherwise) training I have ever attended (I have a BS and many professional certs. But this is far superior!)"

"…it is very apparent that years of planning were put into it. It was one of the most organized and useful training I have had."

"Outstanding program all around - an honor to be a part of. Can't say enough good things."

"The presenters all radiated their passion for plant conservation."

Participants in the APC program have gone on to improve the programs in their institutions, earn graduate degrees in conservation, take advantage of the connections that were formed and in other ways build upon their experience with us. Having reached our goals for the program, it was my hope that we could produce a lasting document that would continue to aid those who did not have the benefit of attending the workshop, hence our production of this humble document. We hope that this manual proves inspirational, helpful and motivating to those who read it.

Contents

Introduction

Thomas A. Grant III
formerly Manager of Research Conservation, Denver Botanic Gardens

Occasionally an opportunity presents itself and you just have to run with it! In a sense, this is how the concept and partnership behind the Applied Plant Conservation Training Program came to be. In 2004, Denver Botanic Gardens and the United States Botanic Garden began discussing partnerships that would increase awareness and action on plant-conservation issues and use public gardens as the medium to address the most pertinent environmental problems. There are many ways in which these goals could be achieved. After reviewing the myriad of conferences and public outreach and training programs available, we perceived a shortage of educational programs that focus on how to develop or sustain programs. We sought to remedy these deficits by instituting the Applied Plant Conservation Training Program. Once our direction was set, we knew that certain groups needed to be included and partnerships formed. We immediately asked the Center for Plant Conservation to work with us, because they coordinate plant-conservation research at more than 30 botanic gardens across the United States and had been developing a complementary professional development program for conservation professionals. Now that our purpose and team had been defined, it was time to pick up the pace and start racing toward the finish line.

The GreenCo Mile High Garden welcomes visitors to Denver Botanic Gardens

Almost every botanic garden likes the idea of engaging in plant-conservation research. The scientific research adds to the garden's existing programs and opens numerous doors to new partners, funding agencies and projects outside the garden walls. Additionally, the scientific research gives credence to the idea that botanic gardens are more than just a pretty place and dramatically aids in the goal of connecting people and plants. This goal, a direct quote from Denver Botanic Gardens' mission statement, lately seems to be a recurring theme in most botanic gardens and emphasizes the importance of making their work relevant to the public. Any administrator or accountant at a botanic garden will tell you that the development of a new department or program is worrisome because of the financial burden. Therefore, the idea of organizing a training program on how to develop and fund research on the conservation of nature was a novel and timely idea.

The Applied Plant Conservation Training Program was realized in June 2005 and repeated in June 2006.

Denver Botanic Gardens was the host for 56 participants from around the world. By using case studies of small, medium and large research programs at botanic gardens (Betty Ford Alpine Gardens, Denver Botanic Gardens and North Carolina Botanical Garden, respectively), we attempted to show the diversity of programs that gardens can participate in and how the work can be funded. The Applied Plant Conservation Training Program also included seminars on fundraising strategies and grant writing that would increase the success of time-consuming fundraising attempts. The program's emphasis on funding, or rather the lack of sufficient funding, called for a narrative of the development of volunteer groups and highlighted the important role they play in increasing a garden's productivity, while directly involving the community. Fortunately, the Georgia Plant Conservation Alliance provided detailed information about their excellent volunteer network and the progressive partnerships they have formed. Finally, if you have a program that is doing good conservation work, it is critical to highlight your progress to the public and your donors. This lesson seems to have caught on in zoos more quickly than in botanical gardens. The importance of interpreting and "marketing" conservation programs was highlighted by United States Botanic Garden and Denver Botanic Gardens staff, who concentrated on what messages to provide to the public and on technical issues in creating and maintaining interpretation. Overall, the Applied Plant Conservation Training Program contained diverse presentations that all focused on developing and funding the programs that aim to understand and sustain the natural environment.

Public botanic gardens have an immense opportunity — and a responsibility — to bring science and society together for the good of humanity and the environment. Over the past decade or two, many botanic gardens have realized that their roles have changed. We are no longer only a place to see beautiful gardens or hear about ancient plant collections hidden in the basement herbarium. Now we are also a venue to educate and inspire the public on the subject of the undeniable interdependency of humans and nature. The goal of the Applied Plant Conservation Training Program rapidly grew into an agenda to provide scientists and land managers with the skills, tools and networks to conduct plant-conservation work, while assisting botanic gardens and nonprofit professionals in the development, funding and sustainability of these programs. Only by providing specific technical training and guidelines for program development and fundraising could the Applied Plant Conservation Training Program accomplish its goals of increasing conservation work and botanic gardens' role in conducting scientific research. On the basis of the enthusiastic feedback we received, we think that our partnership has succeeded. We greatly hope that these proceedings will continue to assist in the development of programs that help humans and nature to live together in harmony.

Conservation, Gardens and Horticulture

Natural Partners!

Kathryn Kennedy, Ph.D.

Executive Director, The Center for Plant Conservation

Most plant enthusiasts don't realize that the flora of the United States is significantly at risk because of our prosperous nation's industrious use of our landscapes. Habitat loss, invasive species, disease and over-collection put many species at risk. Nearly 5% of the flora of the United States is already listed under the Endangered Species Act. Fully 15% of the flora of the United States is documented to be in decline and nearly one quarter of our native species are of conservation concern. These are significant natural resources we can't afford to lose and it will take reasoned and committed intervention to reverse and restore these species to robust condition.

Botanical gardens have expertise and a critical audience. Our nation's botanical institutions are natural allies in our attempts to preserve and manage our plant biodiversity and to recover our most imperiled species. The Center for Plant Conservation works to recruit, train and assist botanical institutions in establishing conservation programs to recover our most vulnerable native plant species. Beginning in 1985, we now have grown to a network of 36 institutions and we have observed a lot of change and growth in our programs during this time. Growing strong conservation programs in local institutions is our business and we hope we can provide some resources to help you get started.

There is no doubt that the best way to "save" plant biodiversity for the benefit of mankind is to maintain it in the wild. Wild populations are the most secure genetic preserves, provided we can achieve multiple robust populations reasonably positioned to avoid simultaneous destruction from natural events. Wild populations can maintain more traits than any sample or seed bank and are very cost effective and low maintenance, as they require the least infrastructure. Multiple populations on the landscape are safer from chance catastrophe than in any building. They maintain their dynamic flexibility to adapt and continue to provide manifold benefits through their ecological services to other living things and nature's sustaining processes.

Photograph - U.S. Fish and Wildlife Service

Robbins' cinquefoil (*Potentilla robbinsiana*), the first endangered plant species that has recovered enough to be removed from the Endangered Species List

Population sizes are dangerously small for many of these species. In 1998, I conducted a comprehensive study of published recovery plans that demonstrated some alarming trends. Conditions have not improved significantly for most species. According to these plans, 65% of the listed plant species had fewer than 10 sites remaining in the wild and 49% had fewer than five sites remaining. Of perhaps greatest concern was the finding that for 74% of the species included, there

were fewer than 100 individuals remaining at the majority of the known sites. This is alarming because populations of this size are very vulnerable to genetic erosion or loss from chance destructive events, although the threat varies by life-history strategy. For most populations of this size, without intervention, models predict extinction within 25 years or less. When populations are in this condition, habitat management alone is probably insufficient to recover them.

It's not surprising then that 87% of recovery plans recommended augmentation of existing populations or reintroduction of plants to areas where they've been extirpated to achieve recovery in the wild. To do augmentation or reintroduction, it is essential to have genetically appropriate plant material available to use in restoration work. *Ex situ* activities — including seed banking, determining germination protocols and cultivation research to understand growth to maturity and be able to produce needed plant material — are essential to prevent extinction and recover our vulnerable plant species. Horticultural research is key to recovery of many, if not most, of our imperiled native plants.

The Center for Plant Conservation

The St. Louis–based Center for Plant Conservation is a nonprofit organization whose mission is to conserve and restore the rare native plants of the United States. Our model for helping accomplish this mission is to serve as a facilitator to build a strong national network of community-based institutions that incorporate plant-conservation programs. Botanical gardens are among the best positioned local institutions to do this. These conservation programs — guided by professional conservation botanists working full-time on the recovery and stewardship of their local native flora (and engaging their staff, students and volunteers) — are incredibly valuable and effective in a variety of roles.

CPC STAFF ROLES

- Coordinating additions to the National Collection of Endangered Plants
- Developing standards and protocols
- Providing technical assistance and training
- Partnering with governmental agencies and others to formulate strategic plans
- Serving as a national advocate for plant conservation and recovery
- Working to educate and raise awareness among the public of the value and vulnerability of our native plants
- Raising funds for collaborative projects and sustained funding through plant sponsorships

Kevin James, Center for Plant Conservation, assists in the reintroduction of Pyne's ground-plum (*Astragalus bibullatus*)

The Center for Plant Conservation was created in 1984 to recruit, train, assist and help support the development of science-based programs by using best conservation practices in institutions nationwide. We currently have 36 institutions in the CPC network. Although originally focused on the traditional horticultural pursuits of collection, storage and growth of imperiled species, our institutions quickly realized that botanical expertise is spread thin in natural resource agencies. We therefore began taking on more responsibilities for these species.

Today our mission encompasses activities in the garden and in the wild. The restoration of our imperiled plants in the wild may involve strategic habitat management, augmentation of existing sites with new plant material or reintroduction of plants into extirpated sites in the wild. It's very

ACTIVITIES OF THE CPC

- Monitoring plants in their habitat
- Securing *ex situ* collections of plant material in seed banks and culture
- Developing protocols for production of material
- Habitat restoration
- Ultimately, species restoration

challenging work, often frustrating, but satisfying and exciting as well. You can learn more about the network and the nearly 700 plant species we are working with by visiting our Web site www.centerforplantconservation.org).

National Collection of Endangered Plants

Our most important asset remains the National Collection of Endangered Plants. This critical tool for the recovery of imperiled plants secures genetically representative samples of plant material (seeds or cultivated material) from wild populations and serves as the foundation resource for research and production of plant material for restoration. The National Collection of Endangered Plants is the only national program, public or private, working to build comprehensive, genetically representative collections of material of our most imperiled native plants.

This *ex situ* work, securing collections of seed for research and restoration needs, involves the holding of collections for long periods of time in the most secure manner possible. The preferred method is seed storage, as you can reliably hold essentially wild individuals for some time without worrying about genetic shifts away from the wild type, as frequently occurs under cultivation. For most plants, such storage involves conditioning the seed and freezing it at –18 degrees Celsius. The best long-term storage condition is even colder through the use of cryopreservation in liquid nitrogen.

Some tropical seed cannot be stored in subzero conditions. For some other species, the secrets to successful germination remain elusive and they cannot be reliably germinated. For these plants, excising embryos from seed and maintaining them in slow-growth tissue culture constitute the next best option for controlled maintenance of genetic lines. Several of our institutions have tissue-culture labs.

The National Collection of Endangered Plants was designed from the beginning to serve as a restoration resource and the work isn't finished when the seed banks are secure. Our institutions conduct horticultural research to develop germination protocols, determine the reproductive system and learn to grow the plants to maturity so that the techniques are known when restoration in the wild is ready to proceed. Often the scientists at CPC institutions are the first to attempt to germinate and grow these native species.

Plants in the Wild

We are also active in monitoring the condition of wild populations. We work to remove threats like invasive species and restore plant communities so that vulnerable species can be reintroduced. Reintroduction is often a very challenging process; it involves a great deal of research on a species-by-species basis to determine the best type, ages and amounts of material to return to the wild and the preparation and aftercare necessary to succeed in re-establishment. This area of restoration ecology is a relatively new scientific endeavor, so it is important to conduct these efforts in a scientific manner and collect good data. Although we do not always succeed initially, we are learning a great deal and are increasingly successful.

As a result of cultivation and reintroduction of plants by one of our participating institutions, the New England Wild Flower Society (NEWFS), Robbins cinquefoil (*Potentilla robbinsiana*) was the first plant species in the United States to be removed from the federal Endangered Species List because recovery had been accomplished. The seed and knowledge that supported that work remains available should it be needed to maintain the species. This is the success story we want to be able to tell for all of our species. We currently have more than 80 projects under way that are working to restore populations in the wild.

WHAT THE CPC LOOKS FOR IN AN INSTITUTION

- A commitment from the highest levels of the organization, including the director and the board of trustees
- A long-term commitment to working for the recovery of these species and building a strong program
- Adequate staff and facilities
- A willingness to follow CPC's scientific standards and protocols for conducting conservation work
- A willingness to build a multidisciplinary team and work collaboratively with agencies and other partners to facilitate restoration and recovery

Organization of the CPC

The Center for Plant Conservation is a selective admissions network of institutions, not because we are elitist, but because we know that successful work in plant conservation requires training and a long-term commitment. The CPC works to train people and develop programs that provide sustained and reliable partnerships for conservation.

The Challenges We Face

The Center for Plant Conservation is effective, but there is a great deal left to do. To meet the need, we know we need to grow in numbers of participating institutions, in technical excellence and in financial capacity and stability. We also need to engage more partners, share what we have learned with the conservation community and tell our stories of hope more widely to the public and to policymakers.

We face significant challenges. Funding is inadequate and unbalanced. Federally listed plant species comprise more than half the listed species, yet receive less than 5% of all federal funding expended to recover endangered species. Botanists are in short supply and good training in the applied scientific issues critical to successful work with plant species is often difficult to find. We need to grow the National Collection of Endangered Plants to "back up" more of our species diversity in *ex situ* collections that are carefully and responsibly acquired and maintained. More research is needed, from horticultural techniques to population biology and ecology. Habitat protection strategies need to be developed and implemented. Restoration of degraded sites and declining populations is needed. We need to develop the knowledge and the funding to support long-term land management needs to keep these valuable species and plant communities in good condition.

A Role for Every Botanical Garden

The challenges we face are significant, but not insurmountable. Every garden may not have the capability to become a CPC participating institution, but there is a role for every garden concerned about conserving our native plant biodiversity.

You representatives of botanical gardens have a lot to offer the nation to help conserve and restore these species. You have a diverse audience that is plant sensitive. You have standing as a community resource and leader. You have expertise and credibility in working with plants. You can teach and interpret information for your visitors in a balanced and responsible way. You have multiple ways to reach out and engage your audiences, within and outside the garden gates. You can bring many voices to bear, as individual professionals, as institutions and collectively as bodies of institutions.

Getting Started

A good conservation program requires competent and enthusiastic staff for the job being undertaken and of course a commitment to quality work. The field of conservation is scientifically diverse and often complex as we work to understand Mother Nature's secrets. Even in purely educational pursuits, accuracy is essential. Working with good conservation botanists inside and outside the garden is a big help.

But a good program involves a lot more than good science. CPC has learned that, regardless of whether a botanical garden is large or small, designing and developing a garden conservation program are just the initial phases of a process for you, your institution and your community. Creating a solid program is a growth process and the work must become a valued part of an institution's culture to be sustained and successful in the long term.

Finding Your Niche

The first step is to evaluate your institution's mission, expertise and current capacity. Plant conservation is a broad field that encompasses a great variety of activities. It's wise to take some time to examine the areas that are the best match for your expertise and capacity so that you can start where you can make the best contribution. What kinds of activities might be effective? What expertise would you need to develop and implement them? What potential resources and partners are there for you to work with? Though by no means comprehensive, Table 1 provides an overview of ideas in a variety of program areas to help you get started thinking about your niche.

Being an effective garden for plant conservation does not only mean working with the small, delicate populations of the most vulnerable species. Plant conservation is a much broader set of ideas and programs, encompassing many different important activities that require different levels of expertise and institutional commitment.

Much potential valuable work may only require establishing an area of emphasis within the existing staff and organization. Other activities would require special conservation biology expertise and might include restoration ecologists or plant population biologists. Conservation and restoration of imperiled plant species demand a good

interdisciplinary team that may include conservation botanists as well as horticulturists and educators. Researchers in other specialties may also be useful on staff or may be engaged through formal collaboration in partnerships with research institutions and other conservation organizations.

Conservation Education

Conservation education is an area with unlimited opportunities to reach a variety of audiences from children to adults (Table 1). One of the greatest assets for plant conservation in botanical gardens is the visitor. When local citizens are informed and engaged in working for conservation and stewardship, we can feel confident that imperiled species can be saved for future generations. Botanical gardens therefore have the opportunity to interpret the need for restoration and stewardship of our flora to literally millions of annual visitors. These visitors appreciate plants, are curious about them and are natural partners for conservation. Visitors can be transformed into volunteers who provide a valuable workforce and/or into informed voices to assist with guiding national policies and securing funding.

Conservation education can be enhanced by one or a few targeted activities a year, such as events or festivals organized around a theme or invited lectures (Table 1 A). More ambitious gardens could develop a full-blown program with strategically master-planned activities in education and interpretation to build literacy around a variety of important issues. There is a natural fit for an educational element for garden audiences that cuts across almost any other area of

Table 1. Planning for Conservation activities

Potential activities	Expertise needed	Partners and resources
General	**A. Conservation education — A little or a lot?**	
Onsite or offsite, irregularly scheduled special events and festivals with or without speakers	Educators Horticulturists Conservation botanists	Agencies, preserves, parks and recreation groups, zoos, other organizations and clubs
In garden or visitor's center, programs that interpret your unique sense of place and local habitat types	Educators Horticulturists Conservation botanists	Agencies, Audubon, parks and recreation groups, schools, native plant societies, garden clubs
Programs on local and national plant-conservation status and trends and on native or foreign display material	Educators Horticulturists Conservation botanists	Agencies, heritage programs, native plant societies
Programs interpreting international concerns	Educators Horticulturists Conservation botanists	International organizations, Office of Scientific Authority of U.S. Fish and Wildlife Service
	B. Promoting low-impact landscapes	
Program to educate visitors about the benefits	Educators Horticulturists Conservation botanists	Environmental Protection Agency, water boards, clean-air councils, zoos, other agencies, organizations and clubs
Program developing stock and demonstrating appropriate plant materials (native or not)	Horticulturists Conservation botanists	Native plant societies, garden clubs, nursery managers
Developing markets for native plant landscape materials, for example, a native plant sale	Educators Horticulturists	Native plant nursery producers, designers, natural resource agencies, native plant societies
Program on designing with native materials	Educators Horticulturists	Landscape architects, nursery managers

Table 1. (cont.) Planning for conservation activities

Potential activities	Expertise needed	Partners and resources
C. Establishing a landscape-restoration program dealing with invasive species		
Endorse voluntary codes of conduct to remove invasive species and prevent their further establishment	All	Exotic pest councils, native plant societies, garden clubs, natural resource agencies, homeowners associations
Serve on exotic pest councils	Horticulturists Conservation botanists	Native plant societies, garden clubs, nursery managers, agriculture representatives
Develop alternative materials for horticultural use	Educators Horticulturists	Native plant societies, garden clubs, nursery managers, landscape architects
Engage volunteers in projects to control invasive species	Educators Conservation botanists	Garden clubs, native plant societies, preserve managers, natural resource agencies
Educate visitors about invasive species in the wild and in the garden	Educators Horticulturists Conservation botanists	Agencies, other organizations
D. Activities in natural-areas protection and management		
Acquire and hold conservation easements or protected preserves	Legal Board of trustees Conservation botanists	Land trusts, natural resource agencies, other organizations
Participate in community efforts to establish a local biodiversity plan and system of conservation areas	Conservation botanists Director Board of trustees Educators	Land trusts, natural resource agencies, other organizations
Serve on planning bodies for existing local preserves	Conservation botanists	Agencies, preserve owners
Assist with maintenance of natural habitats on or off institution grounds	Conservation botanists	Agencies, preserve managers
Provide visitor interpretation for natural areas	Educators Horticulturists Conservation botanists	Natural resource agencies
Engage volunteers to work on preserve lands	Educators Conservation botanists	Garden clubs, native plant societies, preserve managers, agencies
Train master naturalists and teach native plant classes	Educators Conservation botanists	Extension agencies, The Nature Conservancy, native plant societies

Table 1. (cont.) Planning for conservation activities

Potential activities	Expertise needed	Partners and resources
E. Conservation and recovery of imperiled plants — *Ex situ* work		
Secure seed or cultivated collections	Horticulturists Conservation botanists	Natural resource agencies, other organizations
Determine germination and growth protocols	Horticulturists	Agencies, preserve owners
Analyze genetics	Conservation botanists Research staff	Agencies, preserve managers, other organizations
Determine reproductive biology	Horticulturists Conservation botanists	Garden clubs, native plant societies, preserve managers, agencies
Serve on recovery teams and advisory groups	Horticulturists Conservation botanists	Agencies and other organizations, The Nature Conservancy, Audubon
Interpret to visitors	Educators Horticulturists Conservation botanists	Agencies, other organizations,
F. Conservation and recovery of imperiled plants — *In situ* work		
Monitoring and site evaluations	Conservation botanists	Natural resource agencies, universities, native plant societies, garden clubs, The Nature Conservancy
Habitat restoration	Conservation botanists	Agencies, preserve owners, native plant societies
Augmentation	Horticulturists Conservation botanists	Agencies, preserve managers, other organizations
Reintroduction	Horticulturists Conservation botanists	Agencies, preserve managers, other organizations
Introduction	Horticulturists Conservation botanists	Agencies, preserve managers, other organizations

conservation activity. Informal education opportunities to communicate conservation messages effectively can be integrated throughout nearly all aspects of garden activities.

You may be able to do a great service for your visitors by providing information on the conservation benefits of low-impact landscaping (Table 1 B). Your visitors can then apply the information to their own gardens to help save water and energy as well as cut pollution and the use of toxic chemicals. You might also offer training on garden design, installation and maintenance. Developing and helping improve availability of appropriate native plants for landscaping constitute other opportunities to help your visitors. Some of them may be able to use native plants to enhance urban wildlife corridors.

Some institutions may be able to fill a need providing expertise and services in a variety of landscape-restoration activities. Specialized staff could lead programs oriented around particular priority habitats, such as watersheds, wetlands or prairies. Other programs could be issue oriented; as an example, Table 1 C lists some conservation activities related to controlling invasive species (see also www.mobot.org/invasives).

A significant number of botanical institutions in the United States have embraced acquiring and managing preserve lands

for natural areas and biodiversity as a part of their mission. These institutions have found appreciative new audiences eager to learn about native plants (Table 1 D). Others are working with community partners to establish habitat-preserve systems, like Chicago Wilderness (www.chicagowilderness.org).

Institutions working to help restore vulnerable plant species may choose to work on *ex situ* or *in situ* activities or both (Table 1, E, F). Working with vulnerable species often involves work with state and federal regulatory agencies and a great deal of oversight and collaboration. This work benefits from dedicated training in conservation botany or horticulture.

Explore What Is Already Under Way

Take time to explore what is already under way nationally, regionally and locally. You may find our online Conservation Directory, plantconservation.org, helpful in locating contacts in your area. See who else may already be working in a particular area or with a particular focus, or who is interested in a project similar to yours and introduce yourself. Seek advice. Find out what they have been able to accomplish and how. Ask about their current challenges and needs and what you might be able to do to help. Call and meet with your state and federal agency staff and other potential partners.

Explore resources you hear about or find on the Internet that might be helpful. Find out where the experts are, what they have done and written and who might serve as technical and procedural resources.

Collaboration spreads costs, attracts better funding and increases your chance of success, so coordinate frequently with other like-minded individuals and organizations. It's important to keep state and federal agencies well informed and to know and meet their regulatory requirements. They have a legal responsibility, particularly for vulnerable species. You want them to welcome your work, not be surprised or worried about it. Check in with them frequently to let them know how things are going.

Planning for Strength and Sustainability

A strong program that makes a difference in the long term needs the commitment of the entire organization and the community. Remember that creating a solid program is a process of institutional consciousness raising, recognition of value and embracing the responsibilities and challenges as an institution. This process takes some strategic cultivation in addition to good science and worthwhile activities. Work to build recognition and enthusiasm from the bottom up and the top down at the same time. Both are important.

Within Your Institution

You need others in your institution to understand your work. They need to be very comfortable talking about your conservation program as a good thing for the community. Plan carefully and collaboratively within the organization. Share information and ideas widely and seek comments and help. What other departments or individuals might have good advice or could help? Who has helpful professional skills that you do not? The communications department? Education? Development? Research?

Periodically stop and think who in your organization should or would like to know how you are doing besides your supervisor and department manager. Circulate articles, letters and comments. E-mail good news and occasional updates on your progress to build an informed and enthusiastic workgroup.

Be aware of the benefits of your program and be prepared to articulate them to your supervisor, director, board of trustees and your community. Why should they care and continue to support your work? What can you highlight that is meaningful in your organization and shows value and progress? Does your work contribute to central mission values and goals? Have you reached a new audience for the institution? Increased community goodwill and gotten positive feedback? Increased your scientific stature? Do you have new partnerships that are benefiting more than just your project? Have you found funding that helps assist the institutional mission?

Be patient and seek institutional support appropriately. In pursuing new ideas and opportunities, individuals can decide

CHECK OUT Web sites

- Center for Plant Conservation
  www.centerforplantconservation.org
- Lady Bird Johnson Wildflower Center
  www.wildflower.org
- The Nature Conservancy
  www.nature.org
- Botanic Gardens Conservation International
  www.bgci.org
- World Conservation Union (under the acronym IUCN because it was originally called the International Union for the Conservation of Nature and Natural Resources)
  www.iucn.org

quickly. Organizations, including managers, executive directors and boards, usually do not — especially if a commitment reduces flexibility, costs money or is potentially politically controversial. Keep things positive. Think through any potential concerns and do the ground work necessary to address them. Understand that approval of a new activity, program element, budget or public statement can happen only if it is both the right thing for the resource and for the institution.

In the Community, Be a Resource and Build a Following

Ideally your program should be seen as a resource for the public and an asset in the community. This can't happen if you don't get the word out. Invest the time to talk to garden clubs, native plant societies, the cactus society, trails organizations and others. Give brown bag sessions and lectures at your institution. Invite other speakers. Write for your own and local newsletters. Seek PR from local media. Identify local opinion leaders and keep them informed. Get media training so you are comfortable working with the press.

Photograph – Center for Plant Conservation

Volunteers can help with tasks ranging from filing to sorting seed and monitoring plants in the field

Get others engaged. If someone expresses an interest in your work, invite them to come observe the next time you are involved in something they would find worthwhile. Ask for help and recognize and thank them for it when given. Train and use volunteers and interns (see Chapter 4).

Solicit testimonials you can share with your organization, donors and other partners. Let others know that their positive comments will make a difference. If the community values your program, your organization's confidence in it and commitment to it will grow.

Find Funding

Your institution is likely making a financial commitment to cover your salary or in allowing you to work on a new program as part of your current work assignments. Be sensitive to real costs and willing to raise funds to grow your program.

Conservation work is not free. Ultimately the real costs of your program have to be covered by your annual operating budget, donors or grants. In a brand new program, most of this fundraising responsibility may rest on you.

Learn to write grants and find donors to help multiply what you can get done. If you are inexperienced, find others in the institution or conservation community to help you and get some training. Think about who needs your help or would benefit from your program and contact them about your ideas and funding needs. Talk with your co-workers and partners about potential fund sources. Ask donors, funding agencies and foundations if they have any ideas both for short-term funding and for a strategy for building more sustainable long-term funding sources.

Coordinate with others in your organization. Seek their help, formally or informally, to develop a strategy to grow the program and achieve long-term sustainability. Be sensitive to the fact that development staff priorities are set by the organization's leadership, not the staff, so the development staff won't have time to help you unless it is on their work plan. Nevertheless, superiors and development staff should be informed about your intention to contact a potential fund source or submit a grant proposal.

Outside funding is always welcome and the best funding support includes some reimbursement of the institution's general overhead expenses. When you bring in overhead cost reimbursement, you are helping the organization's leadership and development staff cover the cost of keeping the gates open. Find out what the overhead expenses for your department are. Some institutions require a standard overhead rate request in every proposal, though they leave the door open to negotiate reasonable amounts and may accept funding without it. Covering direct project costs is expected. Funding for part of your salary is welcome and may be necessary as well, although you don't want core staff salaries to be covered by unreliable short-term funds for too long.

For more information about funding conservation work, see Chapters 2 and 3.

Work to be an Effective Voice for Conservation

Gardens with conservation programs, or even a concern about plant conservation, have a very valuable voice. Using that voice appropriately provides leadership that serves conservation and raises the profile and stature of your institution.

There are many areas where your institution's voice can be helpful. Think strategically about that. There are places to use the organization's voice and places to lend your organization's voice. Find your organization's comfort level with that. If you think ahead, allow enough time and provide the background information needed, your program can help the organization be an effective leader, by speaking confidently directly or indirectly and stressing the positive.

Don't be discouraged if your organization isn't comfortable speaking formally about an issue you are passionate about. Remember an organization has to think about what is right for the resource and right for the leadership and you usually are not privy to behind-the-scenes situations and concerns.

When you use your personal voice as a professional and not as a part of your organization, be sure that distinction is made. For those of you just starting your professional career, remember to use discretion. Be sure your audience, even in small group discussions, understands when you speak as an individual and when you represent the organization's views and commitments.

Using Your Organization's Voice

Support local restoration work, through community participation in planning, by public comments or by being there with your volunteers. See if you can formalize agreements for partnerships and coalitions to get more done — these formal relationships show the importance your organization gives conservation at the highest levels.

See if someone in your organization can write or visit with program managers in resource agencies about your interest and involvement in plant conservation and your desire to be more effective. Provide drafts or information to support this effort. Making these connections shows the organization's support and raises consciousness about the need to better serve plant conservation within these agencies.

Get approval to participate in writing in public comment processes for planning and regulation of natural resource management. Your expertise and organizational voice is important here.

Ask if your organization interacts with local, regional or national policy makers. Ask if you can help provide *short* briefing materials once or twice a year that the organization might use to include conservation in their conversations. Get instruction about how to produce them. Include reliable, balanced factual information and resources to support a responsible position for stewardship. Share good news of positive partnerships and the interest of your visitors. Thank them for supporting legislation and funding for conservation that benefits the community and your organization, or ask them to do so. Working with the folks in your organization who work with public policy helps them understand conservation as well.

Volunteers collecting *Krameria erecta* in Arizona

Lend Your Voice to Collaborative Efforts

Your organization can also be a leader by adding their voice, thoughtfully, to collaborative efforts. Again, think ahead, allow plenty of time, answer questions, provide support materials and be patient. Stress the positive benefits and credibility for the organization.

Consider strategic endorsements and resolutions. For example, your organization's director or board may consider endorsing the Convention on Biological Diversity's Global Plant Conservation Strategy (www.biodiv.org/decisions) or the Voluntary Codes of Conduct for Preventing New Invasive Species Outbreaks (www.mobot.org/invasives). These endorsements provide an opportunity for discussions with the leadership of the organization and, if they are adopted, may provide a platform for discussion with your members in publications or with the local press to raise public consciousness. Watch for opportunities like this and make your organization aware of them.

Have Fun and Share Your Experiences

Building a conservation program is an important undertaking. It may be a slow-moving process, but it is also rewarding. You will meet and interact with amazing people and that will give you great hope. Above all, have fun. Remember to celebrate your progress and also to share your experience with others who it may help. Building a strong local network of like-minded people is invaluable in getting through the lean times and disappointments. We hope CPC's resources are helpful. Feel free to contact us if we can facilitate your work.

Development and Fundraising Through Gifts: Cultivating Donors

Betsy Cheroutes

Director of Development and Membership, Denver Botanic Gardens

Photograph – Scott Dressel-Martin

Spring blooms at Denver Botanic Gardens' Centennial Gardens

Why would professionals in the field of plant conservation be interested in development and fundraising? Because, if you're armed with development skills, you will have greater control over your destiny. You will be able to attract the financial resources you need to grow your program or conduct your research.

Do you love to tell people about your particular job or program? Sure, it's what you're passionate about. Do you love to ask people for money? I thought so. Once you understand the difference between development and fundraising, you will have a new understanding of why people give and you'll find a new comfort level with asking for their help.

You've heard the adage that "people give to people." That's the primary difference between development and fundraising. Development means forging a long-term relationship with the donor, whether an individual, corporation, foundation or even the government. Fundraising alone will bring in the donations once, but it's through strong relationships that financial support continues and grows through the years. What you're after is that magic match between the donor's interest and your needs.

Donors in the past often gave because it was the right thing to do — they believed in giving back to their communities. Today's donors tell us that they are more interested in "investing" in our programs than simply "giving."

Contributors want to see concrete and measurable outcomes resulting from their investment in our programs. They are not interested in how needy or worthy we are; they want to know the "why" of our request. So we must focus on the impact of our programs rather than our needs. This focus is the key to finding the resources you need to grow your program.

BOX 1
RANKED REASONS PEOPLE GIVE

1. Trust in the institution and its leadership
2. Belief in the mission of the institution
3. Board of Trustees or other official body of the institution
4. Guilt feelings
5. Involved in the institution as an adult
6. Involved in the campaign program
7. Great interest in a specific program
8. Respect for the institution locally
9. Fiscal stability of the institution
10. Regard for staff leadership
11. Leverage or influence of solicitor
12. Respect for the institution in a wider circle — region, nation, state
13. The uniqueness of the project or institution
14. To challenge or encourage other gifts
15. Tax considerations
16. Religious or spiritual affiliation of the institution
17. To match a gift or gifts made by others
18. Community responsibility and civic pride
19. Involved at one time in the institution's activity and received personal benefit
20. Memorial opportunity
21. Recognition of the gift
22. Regard for volunteer leadership of the institution
23. The appeal and drama of the campaign material requesting the gift

From Jerold Panas, *Mega Gifts: Who gives them, who gets them?* (second edition) (Medford, Mass.: Emerson & Church, 2005).

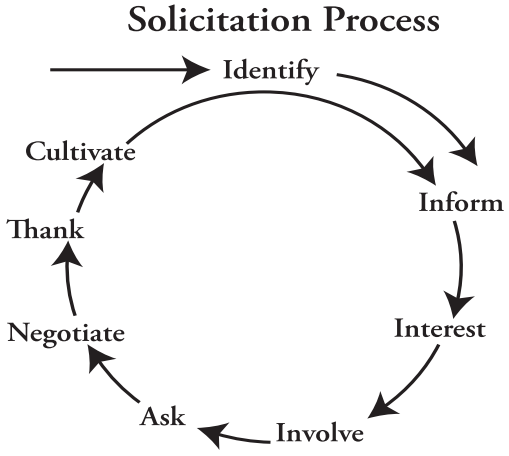
A lot of research has gone into determining why people give money to causes (Box 1). You can see from the ranking that those individuals who are already close to your organization are the people most likely to support you. This realization gives you a clue as to how you solicit new donors — you must involve them in your institution and your particular program before you ask them to give (reason for giving number five). If you do that, you're already most of the way toward your goal of receiving their financial support. This support may come in different forms.

Fig 1

BOX 2
WHO GIVES?

- Individuals tend to give to annual funds and/or make leadership gifts ($1,000 and larger), major gifts (minimums starting anywhere from $5,000 to $25,000 depending on the organization) and planned gifts (such as bequests, gift annuities or charitable remainder trusts).
- Foundations support programs that meet their board's grant-making priorities.
- Corporations want their donations to match their strategic marketing plans; they expect public relations benefits and provide general support, in-kind service, equipment, employee matching gifts and sponsorships.
- Government agencies require that your request match their criteria for funding; they have stringent reporting and accounting requirements.

Fig 2



Solicitation of a gift is a circular process

BOX 3
WEB SITES USEFUL FOR RESEARCHING POTENTIAL DONORS

- www.google.com
  This is a general search engine useful for researching known donors or even for finding new ones (see Chapter 2, "Conservation Program Funding")
- libraries.colorado.edu/screens/article.html
- guidestar.org
  This is a widely used data base and evaluation system for nonprofits. It may be used to research a potential donor and also to see how potential donors who visit the site will view your organization, if you are listed.
- fdncenter.org
  The Foundation Center is the nation's leading authority on philanthropy, connecting nonprofits and the grantmakers supporting them to tools they can use and information they can trust. The Center maintains the most comprehensive database on the U.S. grantmakers and their grants.

TYPES OF GIFTS

- Cash — the most straight-forward
- Appreciated assets — usually stock; a great advantage to the donor who doesn't have to pay capital gains tax on the gift
- Property — houses, boats, art or jewelry
- Planned gifts — life insurance, retirement plans, charitable trusts or gift annuities

BOX 4
GIFT DESIGNATION

- Unrestricted — Everyone's favorite! Such a gift supports the general operating budget
- Restricted — A gift for a particular program or fund within the organization. It is very important to work with the accounting department at your organization so that you can appropriately track the use of the donation
- Current — Such a gift is meant to spend in the current fiscal year and can be either unrestricted or restricted
- Endowment — The original gift is invested and the distributable income from the investment is spent as the donor or trustees designate

Although many institutions have a robust strategy for obtaining government grants, it is also worthwhile to identify individuals who can support your program. It's the individual donors who provide the largest support over time. The gift pyramid (Fig 1) shows the concept that gifts can build from small annual donations to the ultimate gift of a large bequest with the appropriate continued cultivation of the donor. Solicitation of gifts is a circular process (Fig 2).

You must first identify whom you are going to as. (Box 2). Is it an individual, corporation, foundation or government agency? It may be all of them. There are many online resources that can help you identify potential donors and your institution will have a development office that can help (Box 3). Next you must inform them about your program and then interest and involve them. Finally, you can ask for the gift (Box 4). Often, a negotiation stage follows in which you may be discussing the payment schedule and how the donor will be recognized. You get the gift! Thanks follow for all the appropriate parties: you, your supervisor, your CEO and board members. Continued cultivation follows: inform your donor of how the funds are being used, share the outcomes and the evaluation and introduce the donor to the beneficiaries of your program. The cycle repeats itself when you further inform and involve your donor.

Asking can be intimidating, but if you practice and role-play a few times, it will be easier for you. The most important thing to remember when asking for a donation is to LISTEN. We are often so eager to tell our audience how much we need their help and how wonderful our program is that we forget to stop and listen to what is important to the donor. Ask leading questions like "How did you become interested in this program?" STOP and LISTEN to the answers!

DO:

- When it's time for your solicitation, listen for clues and continue to ask questions that require more than a "yes" or "no" answer
- Start with why your needs match their criteria for funding
- Try telling a story about who directly benefits from your work and the impact it made on them.
- Focus on the outcomes (not your needs)
- Demonstrate your ability to implement or continue a program
- Follow the donor's guidelines to the letter
- Report on time
- Keep the donor informed

DON'T:

- Ask for support for a program or services that duplicate existing programs
- Use jargon or acronyms
- Overstate your outcomes
- Stray from the proposal or budget.

Development and fundraising through gifts: Cultivating donors

Approaches and Strategies

Anna Sher, Ph.D.

Director of Research, Herbaria and Records, Denver Botanic Gardens

Photograph – Scott Dressel-Martin

Denver Botanic Gardens' annual Plant Sale provides a fundraising opportunity

Clearly, a conservation program cannot exist without funding. Although a small minority of botanic gardens and other organizations may have full funding for their programs through a general operating budget, most must devote some time and energy (and sometimes a large percentage) toward garnering funds. This chapter covers some of the issues and approaches that have been successful at Denver Botanic Gardens and other organizations. Because grants are generally the primary means by which a conservation program is funded, I emphasize them, but I also address other sources and approaches.

Working with Your Development Department

If you are fortunate enough to have a development department in your organization, approaching them should be your first step. Clearly it is imperative to be actively working with the development team, if this relationship is not already in place.

Some of the key tasks that your development department can help you with include determining or evaluating the institutional overhead rate (if it isn't already established), classifying the funding and administering the funds. Overhead, also called "indirect costs," is generally a percentage of the granted funds that is allocated to general operations that are not specific to the task being funded, but are essential to its completion. For example, overhead may help pay for the office equipment and furniture, the electricity bills and the administrative assistant who answers the phone. Universities generally have very high overhead rates (more than 50% of the grant funds) and to remain fiscally healthy, the universities depend heavily on these monies. In contrast, botanic gardens may have

no overhead rate or a very small one (e.g., 10%). Although a small rate may seem like a great advantage, overhead funds help the parent institution and in some cases can "flow back" to your department to help its operations as well. Thus, if you do not already have an overhead rate established at your organization, it pays to give serious thought to what this rate should be, especially if you are able to have input on setting it. There are federal guidelines for establishing overhead rates for federal grants. Your development department may need to take the lead in getting all of the legal angles covered.

Next, you may need to work with your development department to be clear about how funds will be classified within your accounting system. This step is important for auditing purposes, not to mention general administration. For example, funds may be classified as "restricted," "designated," "operating budget" or other jargon specific to your organization. Correct classification has been an aspect of fund management that required clarification at our organization. Which classification is used may have implications for what happens to funds remaining at the end of the fiscal year or at the end of the grant. Therefore, you must understand how incoming funds will be handled on an organizational level. It is also critical that those persons (in either your development department or accounting) who are responsible for managing your funds fully understand the terms of the funds received. The "sponsor" (individual, group or organization providing the funds) is likely to have very specific expectations about this aspect of fund management, so it is important that everyone involved understands the details from the beginning.

Finally, the greatest benefit to working with your development department may be the administration of the funds. A well-developed conservation program is likely to have several sources of funding coming in at any one time and keeping track of billing cycles, deadlines and reports is often a large undertaking. It is likely that your development department already has administrative systems in place and so it is best suited to administer your gifts and grants. I do caution you, however, to be cautious if the types of grants and other funding sources you are getting for conservation work differ dramatically from the types of sources the development department is used to dealing with. For example, if the primary source of monies for your organization is private donations, dealing with the requirements of federal grants may be new and difficult for the development team. In some cases, it will be easier for your department to handle the administration, or parts of it, internally. Taking the time to work out the details of grant/fund administration is well worth your while.

PRIMARY POINTS TO REMEMBER WHEN WORKING WITH YOUR DEVELOPMENT DEPARTMENT

- Respect the work they do — you need them!
- Take care in figuring out your overhead rate
- Classifying the funding: it matters! (Restricted? Operational?)
- Who will handle administration of the grant?

A Philosophy of Funding

Craft a Vision

No matter how amazing your development department is (if you have one), a conservation program cannot be funded without a program vision to fund. I cannot stress enough how important it is to be clear about your general overall goals and your guiding principles. Having specific projects in mind is not necessarily important when you begin looking for funding, as you will see in what follows, but clearly defining the motivations is important. Are you hoping to help protect specific native flora? To improve habitat? To involve the public in local conservation? To educate children? You may have several goals in mind; thus it may be important to prioritize them. Of course, these goals should be closely tied to the mission of your parent organization (if they do not actually define the mission). Setting goals may require communication with institutional directors, the board and/or whoever has a stake and a say in programmatic offerings at your institution.

Do Good Work

Doing good work involves the principle of keeping your science ethical and working hard, among other obvious goals for any kind of work. The reason, beyond a clear conscience, is that researchers/educators/administrators who are reliable and produce good projects attract attention that will help you get funded. This process clearly operates in the reverse as well. Thus, whenever a hard decision must be made about cutting corners or missing a deadline, never fail to see the big picture. Doing the "right thing" may sometimes hurt in the short term, but will certainly pay off in the long run.

Don't Be Shy

Setting aside shyness is often the most difficult guideline for people working in conservation. We are usually people unused to grandstanding or asking for what we need. However, a little chutzpa is often just the thing that is needed to get your program funded. If you have defined your goals ("crafted a vision") and are proud of the work that you do

(i.e., you are confident that you "do good work"), I find that being bold about asking for support is much easier. A bold request is best for wording in proposals or for approaching individuals, including politicians who may influence grant availability. For example, say that the work is important or critical and that you are the best group to do it!

The Money Is Out There

Don't believe the naysayers. If you believe that conservation programs are impossible to fund, you most certainly will find this belief to be true and be frustrating. On the other hand, if you are confident of your vision, you are doing good work and you aren't keeping all of this to yourself ("don't be shy"). I firmly believe that you will be funded because the money is out there. Of course, there are the typical, large granting agencies with programs having very low funding rates (such as the invasive-species program of the U.S. Department of Agriculture or particular programs of the National Science Foundation), but if you are not myopic about where money should come from (see "be creative and open-minded" below), you will get the support you need. This is not to say that there won't be work involved. I have heard again and again, however, about funding sources that can't find programs or people to support with their money. I've also heard wonderful stories about supposedly "unfundable" programs finding funding.

Be Creative and Open-Minded

I have found that once I was able to believe that the money is out there, I was better able to open my mind to the vast array of funding sources, but for others the order of these two will be reversed. Consider the accompanying, though incomplete, list of sources of funding.

Although it is sometimes easier to fund a program with a single, big federal grant that will cover you for years, everyone is going after these same sources and such grants can be very difficult to win. Open your mind to the myriad of other sources and be willing to use multiple sources for a single project. Also, be willing to give up other preconceived ideas that may hold you back, such as that subcontracting agreements don't allow you to do the work you want to do or that it is somehow immoral to accept money from corporations wishing to "green up" their image. I once heard that, in response to criticism for accepting "tainted" money from oil companies, someone from The Nature Conservancy said, "It may be tainted, but it still tain't enough!"

SOURCES OF FUNDING

- Grants from federal governments, state governments, local governments, institutions, foundations, private organizations and businesses
- Subcontracting agreements from other nonprofits, private individuals and government agencies
- Private donations and bequests
- Donations from corporations
- Collaborations with other institutions
- Endowments
- University sources (e.g., fellowships for student labor)
- "In-house" opportunities during budgeting allocation

The Three Models of Finding Funding

In opening your mind about funding sources, consider the following models for finding funding. It is my experience in talking to dozens of folks about where they found support for conservation work that their responses can be categorized into at least one of the following: Model A — Build It and They Will Come, Model B — Go Fishing and Model C — Make Friends.

Model A — Build It and They Will Come

In the model of "build it and they will come," the idea for the project comes first. This may be the most obvious approach: Develop an excellent project idea and then look for funding that will support it. On some level, the funding model for most projects may, in fact, have an element of this approach, but there is a spectrum. On one end of the spectrum, a researcher may actually completely design a very specific project and even get it started before seeking funding by submitting the same protocol to multiple funding sources. The other end of the spectrum involves having a more general idea about a project and then seeking appropriate funding sources (closer to Model B — Go Fishing). Although having attachment to a specific project may limit your ability to be open-minded (as in the "think creatively" step), I find that if a project idea really is a good one ("craft a vision"), a perfect funding source seems to make itself known. An example of this good fortune from my own career is when I was seeking funding for a postdoctorate to work on native *Tamarix* in Israel. I told everyone I knew

about my goal ("don't be shy"), and someone asked if I had looked into the Fulbright Foundation, which funds international work in all disciplines. As it turned out, the only Fulbright scholarship aimed at postdocs (at the time) happened to be in Israel. I also found some special U.S.-Israel collaboration grants, but in the end, it was the Fulbright that funded the work.

Model B — Go Fishing

Perhaps more common than the Model A scenario is first looking for possible funding sources and then fitting a project to the particular goals of that source. Obviously, one needs to have at least a general idea for a project ("craft a vision"), but one should not be ashamed of designing a project to meet the objectives of a sponsor. This approach is Model B — Go Fishing and then fit the project to the funding that can be caught. For example, if you hear that the local orchid society is interested in funding conservation work, you may consider designing a project around a local, endangered orchid. You may not have otherwise considered that species, but you had a general goal of protecting native flora. As an example from my experience, I designed a project for an agency that was looking for particular deliverables I felt qualified to provide. After taking care to read about the agency and their goals, I customized my proposal to explicitly address them and was successful in gaining funding for the project.

I often see academics take this approach when they find out about a new governmental funding source — new programs within the National Science Foundation or U.S. Department of Agriculture, for example, that may have larger funding rates simply because people don't know about them yet. It pays to be on Listservs and to browse these types of Web sites frequently if one is particularly keen to get one of these big grants and is willing to be flexible regarding the particular focus of the work.

Model C — Make Friends

Model C can be summed up as "if you do good work and meet people, both projects and funding opportunities will arise." For example, when I began as the Research Director at Denver Botanic Gardens, I was approached by another researcher in a federal agency who was aware of my past research and who asked if I would be interested in a subcontracting agreement. This arrangement led to not one but two large-scale collaborative projects (fully funded) as a part of the subcontract and a partnership that yielded other funding opportunities and publications.

The Model C approach is consistent with the principle of "the money is out there" and is more common than one might think. I frequently hear wonderful stories of projects and funding arising seemingly serendipitously at a party or a conference, for example. However, if one looks closer, there is often a foundation in my first principle of "do good work" and also "don't be shy". Model C opportunities most frequently arise when people have projects they can crow about or when the research community is generally aware of the work and it is known to be of high quality. Other Model C opportunities may come about because the people have a reputation of being easy to work with.

The Process

Now that my philosophy of funding and the three models of funding are in mind, I next take you through one approach that can lead to funding. This approach can lead to any of the options already described and should be considered simply one way to get started.

Step 1 — Dream Big

Once your general vision is in place ("craft a vision"), it is time to think about projects. It is very useful to take some time to "dream big". Write out what your dream project might be. In doing so, consider the following aspects: Is the

Field work during the 2006 Applied Plant Conservation Training Program

dream to accomplish a general or specific goal? Does it require working in a particular place? Does the dream include working with a particular person or group? Would you be working on a particular species or group of species? Do you hope to make a specific impact? And if the dream comes true, will it create a reputation for yourself or your institution?

It is best to be honest with oneself about these things. Of course, you may need to work with your organization as a

whole in developing such dreams, but it is not unusual for the board or executive director to expect you to come up with the great ideas. If this is the case, I strongly encourage you to come up with more than one and develop it only so far as makes sense within your organizational structure. I have seen individuals spend days and even weeks writing a detailed proposal, only to find out that the board wants the department to have a different focus. At the other end of the spectrum, I have seen great ideas shot down because they were presented prematurely, without enough thought given to the details. Find out what is required of you by those to whom you are accountable (including partner institutions and other stakeholders).

Step 2 — Identify All the Important Aspects

The first thing to identify is the objective: what is the focus of the project? Other important aspects to be identified comprise project type (whether scientific or management), project size (sometimes called "scope"), the individuals and organizations that constitute your stakeholders and the angles involved. For example, does you dream project have a rare plant angle? An ecosystem management angle? An educational angle?

It will be important to consider each of these aspects, particularly if you want to approach your funding as in Model A ("Build It and They Will Come"). However, even for Models B ("Go Fishing") and C ("Make Friends"), it can be helpful to have thought about these aspects, as they help get the creative juices going and help you pay attention when opportunities arise. For example, by thinking of stakeholders, you may realize that there are folks you should be talking to about your dream project, which can lead to Model C funding.

Step 3 — Begin Your Search

As noted earlier, the key when you begin your funding search is to keep an open mind. Do not restrict yourself to a particular type of funding, nor should you think only about sources that are explicitly conservation or plant oriented (e.g., my previously described experience with the Fulbright Foundation). Besides starting to talk about your project with as many people as possible (to help you develop the idea with feedback from others and to allow Model C to work for you). The World Wide Web is an excellent place to begin your search. Resources I have found helpful include the Community of Science (www.COS.com) search engine, which has listings of funding opportunities from around the world that are specific to science. Another Web site to check is www.nsf.gov/funding and www.grants.gov, which are a good sources for searching for a wide range of government grants. And don't forget Google! Even a general search engine such as Google can yield surprisingly useful leads.

The key to success with any of these resources, however, is the power of good keyword searching. That is, you must identify what words or phrases may be linked to funding sources relevant to your project. To do this, refer back to your list in step two. Again, think creatively. Your project likely has many angles, some of which have nothing to do with conservation or plants. Consider what entities could be considered stakeholders in your project. The medical community? Sportsmen? Educators? Other countries? When searching, use keywords that are related to the project or plant itself (e.g., "plant," "*Tamarix*," "rare/endangered" or "conservation") as well as keywords describing potential interest groups and also possibly any novel approach you may be using (e.g., "meta-analysis" or "surveying people"). I generally suggest that you start broad and then begin to narrow by adding more search terms. Your local (or university) library may have some good resources as well and reference librarians are experts in keyword searching and may be able to help if you are having difficulty.

Funding Types

I will now very briefly cover the major categories of funding sources, including some of their advantages and disadvantages.

Grants

We all think first of grants, but they are not easy money. Although they may seem to be the most popular source of funding for conservation programs, grants have many disadvantages: Overhead means less money to do the work and writing the proposal can be hard. Intense competition often leads to lots of work for nothing. That said, there are of course the reasons why grants are so popular: Once you write one, the rest are easier. A grant gives you the most freedom. Last but not least, grants often provide the biggest pots of money (a million dollars or more) and they benefit your parent institution through overhead.

Besides the already-mentioned digital sources for finding grant opportunities, the following organizations often post requests for proposals (RFPs): American Public Gardens Association (APGA), Botanical Society of America, Ecological Society of America, Society for Ecological Restoration, Society for Conservation Biology and The Garden Club of America.

Subcontracts

Working as a subcontractor gives you less freedom overall and the amount of money can be small. On the plus side, there is often little work to set up a subcontract (SO much easier than a grant proposal). You can be flexible depending on the collaborator. The subcontract may be easy to renew.

Private and Corporate Funding

One advantage of private and corporate funding is that proposal writing is minimal. Also this type of funding may allow you a lot of flexibility. Disadvantages include discomfort asking for funds and the possibility of unclear expectations on either side.

Because private and corporate funding is highly variable, it is difficult to define the pros and cons; however, your development department (if you have one) may be most experienced in this area and best able to help you with this type of funding. (see previous chapter)

Creative Ways to Fund Labor

Funding can be stretched by using volunteers (see Chapter 4) and hiring interns. Some funding sources specifically fund internships. To find interns and or volunteers, contact the Student Conservation Association, Master Gardener programs, citizen monitoring programs, Master Naturalist programs, The Garden Club of America, Earthwatch citizen science program and native plant societies.

Other sources of volunteers and interns are universities and other schools. High school students, undergraduates and graduate students could be drawn into your work. Start by making calls to your local university; talk to professors in your field, department chairs, the financial aid office and the student employment office. Create official associations between your program and the university; options may include work for credit, work-study arrangements and formal internships as well as scholarships.

Fundraisers and Campaigns

For this last category, you may seek to work with your development department to conduct a fundraising event or program to specifically benefit your conservation work. Full-fledged capital campaigns are for an extraordinary expenditure, such as a building, piece of equipment, or for a large project such as the improvement of the organization as a whole. However, fundraising activities do not have to be at this scale. Ideas include:

- **Corporate partnerships:** These can provide 'green' visibility for the company and funds for you. Two recent examples I know of included a store that sold re-usable cotton shopping bags with all proceeds donated to a large conservation organization and a salon chain that cut hair on Earth Day to benefit conservation nonprofits.
- **Events:** Fundraising events can be great fun, such as a concert, fair, or food-oriented event and potentially lucrative. The more specific and exciting the cause, the more motivating to participants, but be sure to know your audience well.
- **Sales:** These may be discrete in time, such as a plant sale event, or on-going, if you are able to provide items in a store (such as your organization's gift shop) that are relevant to and directly benefit you. Cards with endangered species, posters, or T-shirts have all been used in the past, although the out-reach aspect of these sales are usually more significant than their fund-raising power. Know that the up-front cost and risky nature of both sales and events often makes this route prohibitive.
- **Services**: You may also choose to sell your services as a consultant to help fund other projects. Again, this may be discrete in time, or on-going.
- **Giving Programs:** Structured ways that you or your development department can promote giving to support conservation work can make their job easier. This can mean taking advantage of existing menus for donors or developing your own. For example, some have used "adopt-a-plant" to encourage individual donors. The possibilities in this category are limited only by your imagination. There are even web-based programs such as "www.goodsearch.com" that provide funds to registered nonprofits every time their search engine is used. Work with your development department to explore creative ways to either fund your core work or special projects.

The Bottom Line

A good project will eventually be funded — so long as you don't keep it a secret!

Photograph – Scott Dressel-Martin

Staff conduct research at Denver Botanic Gardens at Chatfield

Utilizing Volunteers for *In Situ* Conservation

How to Create a Volunteer Network and Gather Quality Data

Jennifer F. Ceska
Plant Conservation Coordinator, The State Botanical Garden of Georgia

Photograph – Heather Alley

Botanical Guardian Liese Der Vartanian getting a lesson in the field on identifying and monitoring *Carex radfordii* from Tom Patrick, botanist with the Heritage Program

"Never doubt that a small group of committed people can change the world; indeed it is the only thing that ever has."
— Margaret Mead

It is impossible to be in the field frequently enough to watch over all the plant species in need of conservation in remote habitats far from our offices. Years of conservation work can be destroyed by a single event such as damage from all-terrain vehicles, vandals, unethical collectors, herbicide and even feral hogs. If rare plant habitats are not monitored carefully enough to detect and respond to these events, plant populations or entire species can be lost forever.

We need help. We need more people involved with *in situ* plant conservation, more hands and eyes across the land. In our case in Georgia, we were initially slow to ask for help and too wary to trust "nonprofessionals" with location details for endangered plant species and this caution was prudent because collection of plants species from the wild is one of the top threats to rare plant populations. Our fear of what could happen if rare plant localities were shared prevented us from asking for help. Unfortunately, it required a dramatic and biologically costly event to force us to reach out and trust others and very fortunately for us, a well-established and highly credible friend, the New England Wild Flower Society, had paved the way and was willing to mentor us on developing a program utilizing volunteers for conservation. Like every good southern experience, our program using volunteers for plant conservation begins with a story.

The Battle for Bullrun Bog

Our story begins in southeast Georgia, not too far from Savannah, but a good four-hour drive from the botanical gardens participating in the conservation of pitcher-plant bogs 12 years ago. There is a pitcher-plant bog (we will call the site "Bullrun Bog" for the purposes of this story) that is listed by both The Nature Conservancy of Georgia and the Georgia Department of Natural Resources Heritage Program as the most biologically diverse habitat in Georgia. The Bullrun Bog has the only Georgia Coastal Plain population of *Sarracenia purpurea* (purple pitcher plant,

a Georgia endangered species). The pitcher plants in this bog are significant genotypes within the southern range of the species. Some of these purple pitcher plants are estimated to be over 100 years old. Coastal Plain pitcher-plant bogs in general are among the most biologically diverse habitats in all of North America. They are wet, wildflower meadows within the diminishing longleaf pine ecosystem, dominated by grasses (*Aristida beyrichiana*, wire grass; *Sporobolus junceus*, piney woods dropseed) and carnivorous plant species such as pitcher plants (*Sarracenia* spp.), sundews (*Drosera* spp.) and bladderworts (*Pinguicula* spp.). Multiple species of each genus are found within a single bog. Coastal Plain pitcher-plant bogs also hold terrestrial orchids (*Platanthera* spp., *Cleistes* spp., *Spiranthes* spp. and *Calopogon* spp.) and other strikingly beautiful flowering species such as *Balduina atropurpurea* (purple honeycomb heads, a Georgia rare species) and *Macranthera flammea* (hummingbird flower, a Georgia threatened species). Bullrun is a 45-acre bog owned by multiple private landowners. It survives under a power-line right-of-way (ROW). ROWs are among the few places some sun-loving species survive in a region in which fire has been suppressed for generations. Although power-line ROWs are a welcome refuge, management under these ROWs remains challenging, as you will see later in this story.

Georgia Plant Conservation Alliance and New England Plant Conservation Program

In 1995, the major botanical gardens in the state of Georgia came together and initiated a coalition of organizations all actively involved in plant-conservation research and education. The group is called the Georgia Plant Conservation Alliance (GPCA); its headquarters is at the State Botanical Garden of Georgia. The alliance is based on the model of the New England Plant Conservation Program (NEPCoP): (www.newfs.org/conserve/index.htm), developed by the New England Wild Flower Society (NEWFS) at the Garden in the Woods. William (Bill) Brumback, conservation director of NEWFS, was generous with his time and straightforward advice about how to efficiently coordinate Georgia's statewide alliance. We could point to the success of NEPCoP, as we explained to prospective partners and potential donors, our twin goals of *in situ* conservation and application of horticulture conservation to safeguarding genotypes at botanical gardens.

By using NEPCoP as a model and applying it to a single state, the GPCA (www.uga.edu/gpca) has become a project-driven alliance that has not spent its time on memorandums of understanding, boards of trustees or nonprofit status. GPCA partners were clear from the start that they did not want to create another bureaucracy. When we gathered together, we wanted to talk about plants and projects, not paperwork. The design of GPCA is simple with a project coordinator (Jennifer Ceska), chair (Dr. Jim Affolter) and a coordinating committee made up of three representatives who can confer on short notice should a decision need to be made. The group gathers three times annually to review conservation activities and receives priority project suggestions from the Georgia Department of Natural Resources. Throughout the year the members work together in the field to restore critically endangered habitats, safeguard genotypes at the botanical gardens and manage *in situ* safeguarding sites on protected land. Restoration of Bullrun Bog and other pitcher-plant bogs has been a top priority of the GPCA since the organization's inception.

Trouble

Bullrun Bog is managed by a major southern electric company that was eager to protect this botanical hot spot. Botanists flew over the site in helicopters, mapping the bog and the power lines running through the site, writing management plans, working with the private landowners and monitoring the restoration of this complex of eight bog microsites. Agreements were signed at the state and corporate levels designating Bullrun Bog as a Special Management Zone. Orange metal signs were placed around the bog to alert maintenance crews. And then the bog was sprayed with herbicide.

In an effort to save time and money, many utility companies in southeastern United States are turning to herbicide rather than more traditional methods of mowing to keep vegetation low under electric and telephone lines. Although pitcher plants will grow no more than two feet tall, they were sprayed directly by seasonal employees walking the site with backpack sprayers. Contractors are in charge of the management of the power-line ROW. Their seasonal employees probably could not read the warning signs because they were written only in English. Members of the GPCA team wouldn't learn of the incidents until one of our monitoring trips rolled around on the calendar, usually only twice a year. GPCA members at the Atlanta Botanical Garden scrambled to rescue seeds or bits of rhizome to supplement their safeguarding collections for this site. The herbicide spraying happened twice over a series of years. And then the all-terrain vehicles came. It turns out that soft soils are great fun for the riders of ATVs who can go "muddin'" through the power-line ROW and the site was ridden hard. Deep wheel ruts changed the hydrology of the site by draining some areas of the bog and flooding others. After having come so far in its restoration, the site was devastated and our hopes were dashed.

Photograph – Martha Joiner

Food plot plowed in a section of Bullrun Bog and Special Management Zone sign used for target shooting

All plans for reintroduction of indexed plant material to Bullrun Bog stopped. Further efforts to restore the bog were also put on hold. We couldn't invest more time, money and resources into restoring this site, as significant as it was, until the herbicide applications and the ATV rutting stopped. We tried many things, including introducing ourselves at the regional offices of Georgia Power, the utility company and following the ATV lanes to nearby neighborhoods to talk about the bogs. But these visits happened annually and the characters in our story changed quickly and often. Power-line contractors, hunting parcel agreements and ATV owners were constantly changing. We needed someone local to cultivate relationships with all of these forces affecting the bog. We needed someone to walk the site regularly, keep an eye on these activities and talk to people on site. Someone coming in from another part of the state, from the bigger cities, wasn't always looked upon as favorably as someone local. We needed to find a neighbor who could be our partner in this project.

Our First Local Stewards, Hewett and Martha Joiner

Our luck began to change when Georgia Southern Botanical Garden (GSBG) joined the Georgia Plant Conservation Alliance (GPCA). With them came Martha Joiner, a grandmother and board member of GSBG who had just completed her master's degree in biology at Georgia Southern University. Martha and her husband Hewett would become the local stewards for Bullrun Bog. They began walking the site and reporting to GPCA what they were finding. Their participation quickly became indispensable. They met with employees of the local power company regularly, reminding them of the special plants in the management zones. They even got management of the site turned over to their leadership for five years and used GPCA and local native plant society volunteers to hand cut the woody plants in the right-of-way. They developed relationships with the landowners and helped staff of the Georgia Department of Natural Resources cultivate those relationships to the point that prescribed fire is now requested by landowners at the site. They collected seeds for safeguarding and monitored the rare plant populations. The ATV trouble still rears its head whenever another group of teenagers discovers the site for muddin'. But Hewett and Martha have documented the damage and the number of times the offenses are repeated. Their data have moved the state to invest in fencing for the microsites to protect the rare plant species. Because of the local effort and diligence of Hewett and Martha Joiner, Bullrun Bog has a real chance to not only survive, but to thrive.

Photograph – State Botanical Garden of Georgia

Georgia's first Botanical Guardians, Hewett and Martha Joiner at Bullrun Bog

A Model and a Mentor: New England Wild Flower Society's Plant Conservation Volunteers

It was clear to us that the success at Bullrun Bog depended upon the help of Hewett and Martha Joiner as local stewards for that site. This is just one of hundreds of sites in remote areas of Georgia that need volunteer local stewards. We needed to expand this success into a program, a network of volunteer local stewards around the state working with GPCA. But botanists with the Department of Natural Resources (DNR) Heritage Program were very hesitant to bring nonprofessionals into these critical rare plant habitats. Could these volunteers be trusted? Was their work accurate? Was the time spent finding and training them worth it? DNR was comfortable with the participation of Hewett and Martha Joiner because of Martha's association with the Georgia Southern Botanical Garden, a GPCA member. But to help us with our *in situ* work, we were now talking about finding volunteers who were not necessarily associated with a GPCA organization.

Once again and fortunately for the GPCA, the New England Wild Flower Society (NEWFS), had already paved the way, demonstrating huge success with their volunteer workforce. In 1998, they initiated a program called the Plant Conservation Volunteer (PCV) Corps. PCVs were initially trained to help Heritage Program botanists survey rare plant populations. Bill Brumback was sympathetic to the dilemma we faced securing the confidence of Georgia's Natural Heritage Program (GNHP) botanists. The NEWFS had to overcome similar hesitations with their Heritage Program offices. But the quality of the volunteers that NEWFS produced, the special training they received, the commitment they demonstrated and the value of the data they brought in quickly outweighed any concerns that the Heritage officials had.

As with every other conservation program they initiated, NEWFS and the New England Plant Conservation Program worked through the process so carefully and professionally that the Plant Conservation Volunteer Corps was very successful. The PCVs quickly spread through all six New England states. The roles of the PCVs also quickly expanded beyond monitoring rare plant populations to include other tasks such as restoration, invasive-species survey and removal and general botanical surveys of sites. The PCVs were also attracting significant attention from the media, who wrote articles about this grassroots movement that was making a difference for plant conservation. NEWFS now has a full-time staff of four people and two six-month fellows to coordinate 499 volunteers throughout New England, donating 29,989 hours of volunteer work.

The opportunities to utilize the skills of these specially trained volunteers just keep growing. The NEWFS was awarded a grant in 2002 to monitor the spread of invasive plant species by using another team of specially trained volunteers. They are collecting data for the Invasive Plant Atlas of New England project (IPANE) at the University of Connecticut. IPANE is an Internet-based project that is mapping the distribution of 100 invasive plant species (www.invasives.eeb.uconn.edu/ipane/). The distribution data will help conservationists track and potentially slow the spread of these invasive plant species. NEWFS coordinates over 750 trained IPANE volunteers.

The NEWFS sees mentoring as part of its mission, to help other organizations establish conservation programs in their own regions. Bill Brumback and his team were a great help to GPCA when we were establishing our conservation alliance and statewide conservation projects. Now they were helping us once again, sharing with us the details for setting up a network of volunteers for conservation. Chris Mattrick, senior conservation manager of the NEWFS Plant Conservation Volunteer Corps, was well versed in the details of how to get this program to work. He graciously hosted two of our Georgia volunteers, professional photographers Hugh and Carol Nourse, at two of his volunteer training sessions in New England. The Nourses made arrangements and paid their own way to New England to attend these training sessions, bringing back copies of the NEWFS training manuals, volunteer paperwork and publicity pieces. The Nourses then trained garden staff at the State Botanical Garden and used the NEWFS material to create the first draft of Georgia's volunteer training manual.

Amplifying the Effect of Local Stewards: Bringing the Model Home

Project Coordinator

The very first thing we needed in Georgia in order to create a network of volunteer local stewards was a project coordinator to organize and train volunteers, prepare location and description information packages for each project, obtain landowner permission and supervise data collection. Having a project coordinator for the volunteers right at the beginning of a volunteer program has been the sage advice from NEWFS conservation director Bill Brumback. As coordinator of the Georgia Plant Conservation Alliance, I understood the importance of having someone to drive a program day to day. Now we needed a similar position for our volunteer network, even if that person started part-time and the hours expanded as the position grew. In 2003 we

hired Heather Alley, a conservation biologist with a master's degree from the University of Georgia. After the experience of Bullrun Bog and the power-line right-of-way, Georgia Power officials and the Heritage Program botanists were eager to find local stewards for 31 rare plant populations under Georgia Power transmission lines. Georgia Power became a partner of GPCA; the utility company hired a biologist to help map the rare plant and animal sites on their power-line ROWs.

Georgia Power also worked with Heather to create a list of restoration activities at each of these sites.

Botanical Guardians as Local Stewards

In 2003 Georgia officially launched its Botanical Guardians program with local stewards at 13 power-line sites. These stewards quickly proved their worth by going beyond monthly monitoring reports. At the site of the last Georgia population of *Ptilimnium nodosum* (harperella, federally listed as endangered) a power pole caught fire when a transformer was struck by lighting. Fire trucks and later trucks used by the pole-replacement crew drove all over the population, rutting the wetland soils of this site. Heather's volunteer local steward, Ed McDowell of Bonaire, Georgia, carefully followed the entire incident and collected seeds of the endangered annual in case the population was unable to recover from the traffic. Without Ed's careful monitoring, it is likely that Heritage botanists would have missed this event. It could have been several seasons before the species rolled around on the monitoring schedule. Another local steward, Kathryn Litton of Blairsville, Georgia, stopped DOT contract mowers literally in their tracks before they mowed down a biennial species in full bloom, *Gentianopsis crinita* (fringed gentian, a Georgia threatened species), as they had done for several previous years even though the site was posted with "do not mow" signs. The Botanical Guardians were helping to save rare plant populations.

> *"The key to a successful volunteer monitoring program, beyond the initial commitment of the institution itself to conservation, is a staff member whose position is dedicated to identifying, recruiting, training and coordinating volunteers. In my experience, this dedicated staff position is the most critical piece of a volunteer monitoring program."*
>
> — Bill Brumback

Botanical Guardians as Species Search Teams

Volunteer Coordinator Heather Alley was given the task of persuading our Heritage Program botanists to share location data of rare plant populations and to allow volunteers to monitor these sites. At that time, the GNHP had only two botanists on staff covering a state that ranks sixth in number of plant species. In addition, Georgia's forests had previously been replaced by pine plantations that were now being converted to housing developments because the state has one of the fastest rates of population growth in the country. Nevertheless, the state botanists wanted to start slowly and test the volunteers first. Rather than start with Georgia's G1 or endangered plant species, they started with 10 historic species, that is, species that are not listed or protected but hadn't been seen in the state for at least 20 years. The location detail for these species was cryptic at best. Using field notes and herbarium records from botanists long since deceased, our species search volunteers went out to search in the wilds of Georgia armed only with bug spray and snake sticks. They found nearly all the species assigned to them. In some cases, the data led them to locations that are now under pavement. In others, such as the search for *Justicia angusta*, volunteer Carol Schneier realized the plants were originally identified incorrectly. State botanists later confirmed her identification that the species previously observed was actually *Justicia ovata var. lanceolata*. Richard Ware of Rome, Georgia, found yellow giant-hyssop (*Agastache nepetoides*), which hadn't been seen in Georgia in over 25 years. One species, *Silene regia*, was thought extinct in Georgia, but

Photograph – Hugh and Carol Nourse

Gentianopsis crinita was mowed during full bloom annually by county and state contract mowers until Botanical Guardians began watching these sites carefully.

volunteer Jeff Painter found it and has since helped restore the site with reintroductions of plants propagated from seeds from this original site. The species search team proved their merit by contributing over 210 hours of field work monitoring rare plant populations and helping the Heritage Program prioritize its conservation projects for these lost, historic species.

Botanical Guardians' Expertise Sought

Since 2003, Heather Alley and her Botanical Guardians have taken on more species search and local steward projects, contributing an average of 300 hours a year. Botanists with the Heritage Program asked Heather to add more species and now the total is up to 54. Some of these are among Georgia's most critically endangered species and volunteers are being specially recruited and trained to help collect seeds and cuttings for safeguarding. Ecologists with The Nature Conservancy of Georgia have asked Heather to establish Botanical Guardians for their preserves and the state parks have asked Botanical Guardians to monitor their rare plant populations. Botanist Tom Patrick of the Heritage Program said at a recent Georgia Plant Conservation Alliance meeting, "Botanical Guardians are a great way to get things done".

Planting the Seeds for a Volunteer Program

Hire a Volunteer Coordinator

As already mentioned, hiring a volunteer coordinator is critical to creating a network of volunteers. Consider carefully the skills needed. When seeking to fill this position, consider someone with good people skills. The volunteer coordinator must have the ability to work with conservation professionals and local landowners. For example, the volunteer coordinator must be someone who can reassure property owners who have exaggerated concerns about rare species and their land. Another requirement is familiarity with all aspects of conservation biology, from seed collection to restoration, to invasive-species management and population monitoring. In addition to being good at creative solutions, the volunteer coordinator must not be easily daunted by obstacles such as sifting through the most obscure herbarium records when trying to locate rare plant populations and deciphering the most abstract landowner references in the tax records.

Cultivate Support from Your Institution

Creating a volunteer network for plant conservation is a great public relations opportunity for your botanical garden. You need to sell this concept to your director, board of advisors, public relations staff and development officers. Because your garden's administrators can also help recruit new volunteers and potential donors to your program, keep feeding them stories from the field and images of volunteers doing their good work. Share your enthusiasm for this work and for the valuable data the volunteers will be collecting. These volunteers are often the only trained conservationists visiting these rare plant populations and they will surely acquire some dramatic stories while protecting these sites through their regular visits.

Secure Funding

The good news is that a volunteer program does not require a great deal of field equipment, office space or staff. The even better news is that donors seem to be attracted to grassroots programs in which volunteers are working with scientists to get a lot of good field work accomplished on behalf of endangered species. The New England Wild Flower Society secured a large grant with multi-year funding when they initiated their volunteer network. This grant helped ensure that the program had financial support as it navigated those first bumpy field seasons. Funding from a prominent foundation also adds to the program's credibility, especially in the beginning when you need to convince Heritage Program botanists to trust you and your volunteers with rare plant population location information.

NEWFS began with a staff of one project coordinator for volunteers, but as their program excelled and expanded, they needed additional support staff. Volunteer networks are flexible by design. One volunteer coordinator can begin your program. That person will need a computer, access to the Internet, a phone and filing cabinet. Other overhead includes overnight shipping when a volunteer needs to send seeds or cuttings to you from far away and expenses as the coordinator travels to training sessions around the state and takes volunteers into the field for the first time to orient them to their projects.

In Georgia, we were only able to fund our volunteer coordinator part-time. Heather Alley, with two young children, appreciated having the opportunity to work part time and grow her position as the program (and her children) grew. We raised soft money for her salary, through an annual letter campaign to our regular donors. We received several small grants from local foundations initially and later we received larger, national grants from organizations such as the National Fish and Wildlife Foundation and Bloom, Inc. But fortunately for us and as a testament to the good public relations our garden receives from this program, we have never had to cut back Heather's hours for lack of funding. Other conservation staff at the botanical garden, including our Director of Research and Conservation Coordinator, helped raise the money for the volunteer coordinator position

by writing grant proposals and giving presentations to foundations and garden clubs. Our botanical garden also had infrastructure in place that could be used by the volunteer coordinator like a field vehicle and field supplies from our research department. Our program still operates on soft funding and securing funding (see Chapters 2 and 3) for our volunteer coordinator remains a top priority of our botanical garden's conservation program.

In the future, we hope to secure more funding for additional GPS (Global Positioning System) units and field-study laptop computers. Heather has purchased items like loppers and other hand tools for removing invasive woody species. She has purchased safety vests for volunteers who are monitoring populations on the sides of busy roads and highways. Volunteers have supplemented the program by using their personal cell phones to call in from the field to confirm identification of a species or request permission to collect seeds when a problem in the field is identified. They are also using their own digital cameras to document populations and to show examples of threats such as all-terrain vehicle ruts and invasive species. Cell phones and digital cameras are used regularly and it would be nice to be able to compensate volunteers in some way for using their personal equipment.

Establish a Track Record

Start with a few carefully selected volunteers and projects. When Heather started this program in Georgia, she needed to prove to everyone — herself, the state botanists, botanical garden administrators, donors and other professional garden colleagues — that volunteers could carry out their field projects professionally and that the time invested seeking, training and coordinating them was worth the investments. She first approached those stellar volunteers that every botanical garden has, the ones who are practically unpaid staff. She knew she could trust them with rare plant location information. She also knew they would work diligently on their project, taking careful field notes and honestly reporting all they found.

Having five projects during the first year is not unreasonable. Show that your team can do this work and do it well, before taking on a longer list of projects with a new network of volunteers. Heather Alley is now a seasoned professional, coordinating a statewide network of volunteers. She often remarks about the intensity of the field season, when she feels like an air traffic controller coordinating 100 critically important details every hour.

Starting slowly and quietly with a few carefully selected volunteers also helps the volunteer coordinator fine tune screening methods. There are plant collectors out there with unethical attitudes about plant diversity. In Georgia, we lost the last population of whitetop pitcher plant (*Sarracenia leucophylla*) to plant collectors. Therefore, we didn't want to broadcast this program initially. We started with volunteers we knew and we tested our volunteer application forms and training methods on them. By growing the network slowly, perhaps even by word of mouth the first two seasons, you also develop a community of volunteers who can help supervise new recruits in the field.

Growing a Volunteer Program

Recruiting Volunteers Takes Time

Recruiting volunteers will take time, but when you find good folks, it is all worth it. Just keep on telling your story to everyone who will listen. Volunteer Coordinator Heather Alley says she is always looking for more efficient ways of finding and screening people as volunteers. She spends a great deal of time chasing false leads, training volunteers who simply fade away with their busy schedules or giving presentations to groups who don't bring forth new recruits. But then there is that one presentation that locates a volunteer who makes it all worth it in the end. Keep talking about your volunteer program and have your colleagues work it into all of their presentations. You never know when that new incredibly dedicated volunteer will show up. A colleague of Heather's talked about the Botanical Guardians program at a teacher-training workshop and found new volunteer Walter Blanks, who has taken on four projects this year in a very remote part of our state.

The New England Wild Flower Society has a wonderful strategy for finding trained volunteers. They have a catalogue of over 250 courses in all areas of plant conservation from classic botany and taxonomy to monitoring plant populations. Offering these classes has created a pool of trained students and potential volunteers — an ideal example of their methodical success. Our garden is starting a similar series of classes leading to a certificate in native plants. We hope to get to the point of having such a large pool of volunteers that people will have to qualify to participate in monitoring endangered plant species.

Reluctance of Heritage Program Botanists

Getting project assignments from Heritage Program botanists may also take time. The New England Wild Flower Society gave us a heads up on this challenge, so we were ready to pull back on our reins despite being eager to get into the field with a slate of top-priority projects. The botanists did not greet our Botanical Guardians program with open arms and automatically give us access to endangered plant populations. They were hesitant and had many questions about the program, its process, the training and screening and the quality of the data collected. Still, having an established program like New England's to refer to did help ease the way for our program in Georgia. We could point to the success of the NEWFS Plant Conservation Volunteers, the vast field hours contributed by "nonprofessionals" and their example that volunteers could do good science. Nevertheless, our program was first tested by our state botanists who assigned us projects like finding species no one had seen in 20 years. Heather and her team passed those tests beautifully, but it was a bit frustrating doing this work when so many other species were known and remained critically rare and in need of attention. Still our patience held and we took the steps to establish the program's credibility at the pace set by our state botanists. The volunteer network proved itself credible. Now we have all the work we can possibly handle.

State Natural Heritage Program botanists also receive a benefit that they may not have anticipated. When dealing with the public and landowners, some of whom have quirky personalities, Heather Alley and her volunteers shield our state botanists from a flood of questions and confusion. The Botanical Guardians program serves to buffer the state botanists.

Advertise Your Program

Once you have a few seasons of experience, advertise your program every way you can think of through colleagues, brochures, articles and the Web. Prepare a PowerPoint presentation about your volunteer program and have a well-polished delivery. Now hit the road and talk to every group you can — garden clubs, plant societies, service clubs, teacher organizations and scout groups. Provide images for your colleagues to use in their presentations so they can include a quick word about your volunteer program. Create a rack-card about your program, even if it is printed in only one color initially. Write articles and interview for the local paper. The New England Wild Flower Society has had huge success with local papers featuring stories about their volunteers. Newspapers and potential donors seem to respond best to field stories about our volunteers and their adventures in the wild. Also, consider including a description of your volunteers' projects on your garden's Web site with images of your volunteers in the field. Set up an online application form that is sent by e-mail directly to your volunteer coordinator. You may get some false leads this way, like an application from "Mr. Ted E. Bear," a "conservation colleague from the local zoo!". But you can also reach a wider audience of potential volunteers with little expense and their contact information is electronically in hand from the beginning when accepting applications via the Web.

Fight the Impulse to Do It All Yourself

Sometimes the plant phenological clock is ticking and you know you have to get someone in the field to find that rare species in flower before the season passes and you lose another year. Or you are concerned the fruits will shatter before someone collects them. Or far worse, you find out that the land you were trying to get permission to visit has been sold to a developer for a strip mall. With the time pressures of imperiled species and developing a network of volunteers, it is very easy for the volunteer coordinator to head to the field to try and do it all. But spending time

Photograph – Tara Muenz

Botanical Guardian David Varnadoe marking *Salix floridana* in power-line right-of-way before contractors bush-hog the line

tracking down and training those volunteers will eventually pay off with far more hours in the field than the volunteer coordinator could contribute alone. Truly, the volunteer coordinator will likely spend a great deal of time in the field, training volunteers and orienting them to their new sites, especially when the program is just beginning in an area.

Screening and Secrecy Agreements

Screen your volunteer applicants and ask them to sign a secrecy agreement. Carefully screening your volunteers will go a long way toward easing any concerns of your professional conservation colleagues about releasing rare

plant location information to volunteers. Have everyone fill out detailed contact information in case you need to reach them quickly when something dramatic is happening (like a bulldozer entering a site). Include emergency contact information in case something should happen to them in the field and you need to reach family. But also include in your application a few questions to get at their motivation. For example, how did they hear about this program, why do they want to participate and where did they last volunteer? Ask for references and call them up for an honest conversation about the volunteer.

Every volunteer will need to sign the secrecy agreement. In our experience this agreement is taken very seriously by volunteers. They must promise not to disclose the locations of rare plant populations to anyone. Conservation professionals feel very strongly about the importance of limiting knowledge of rare plant locations for fear of unethical plant collectors. So do private landowners who don't want just anyone coming onto their land. In Georgia, there are two mountain bogs left, one on Forest Service land and one on private land. The last mountain purple pitcher plant was stolen from the privately held bog. The landowners have literally chased people off their land who were running away with buckets of plants. Landowners want to know that any volunteers you are sending their way are going to keep their location a secret.

Two for the Price of One?

Consider allowing volunteers to take a friend in the field with permission from the volunteer coordinator and a signed secrecy agreement from the friend. The New England Wild Flower Society feels differently about this than we do, perhaps because they have such a large pool of volunteers to draw from and a well-established and successful volunteer program. They do not allow their volunteers to take anyone who is not an officially trained volunteer to any rare plant locations. They set their volunteers up in teams, often pairing new volunteers with a mentor volunteer to help further train them in the field. This approach creates a buddy system, allowing people to go into the field with a friend for safety. In Georgia, we have a smaller network. And although we try to have pairs of volunteers trained together for each project (spouse teams being ideal), Heather often has volunteers who are dedicated but concerned about going into the field alone. She will give them permission to bring a friend for security and safety, as long as they ask special permission first and have the friend agree to and sign a secrecy agreement.

Training Your Volunteers

Landowner Permission

Never enter a site without landowner permission. This rule needs to remain hard and fast. It reinforces your program's credibility and demonstrates your level of respect for the landowners. The volunteer coordinator will have spent a great deal of time with county records to determine who the landowners are. As recently as 2004, this step required someone to physically go to each county courthouse to look up landowner information by parcel. Now, many counties have this information on line. Even these leads can be problematic, however. In one case, Heather needed to reach the landowner for the area with the last population of *Thalictrum debile* (trailing meadow rue, a Georgia threatened species) in Georgia. The county records turned up an obscure post office box for a boat manufacturer in a distant state. She could find no names to contact even online. She sent a cold-call letter out, very nearly written "to whom it may concern," thinking there was a great chance she'd never hear a word back and wondering what we would do if this was a complete dead end. But a few weeks later, she did receive a reply by mail giving permission to monitor the site and take plant material for safeguarding at the botanical garden.

Sometimes professionals in conservation are wary about contacting private landowners for fear of having the door permanently shut in their face and access to the plant population completely withdrawn. Some owners do have concerns that a government entity will take their land away from them or restrict their use because of a rare plant species. But with a little education on the limited laws protecting plants, 99% of the landowners we've encountered have been more than willing to let us visit their land to monitor and eventually restore their rare plant populations. Dealing with an employee from a botanical garden rather than a governmental department seems to ease landowner concerns. We come across as wildflower lovers rather than any kind of legal or political threat.

Heather has found that most of the time the landowners provide her with valuable life history and land-use information about the rare plant species. Recently, she had another adventure tracking down a landowner through a series of leads. Heather learned from the newly contacted landowner that this land was under legal protection from development because of an endangered fish and therefore the population of *Berberis canadensis* (American barberry, Georgia endangered species) was protected as well. The landowner was tickled to know there were additional rare species on her land and pleased to report its protection to

Heather and to state botanists. The landowner gave Heather and Botanical Guardians permission to come to her land for the monitoring and safeguarding work. Then the landowner reinforced another reason to always ask permission before entering someone's land when she indicated that Heather should have the volunteers meet with her the first time they come so they could meet her dog. Otherwise, she said honestly, her dog might, "tear you a new backside."

Beyond private landowners, don't forget to get permission from managers of public land. Staff at state parks or other wildlife management areas may not be specialized in plants and would really value learning more about the species under their care. It is easy for volunteers to slip in and out of public lands while carrying out their monitoring assignments, but cultivating relationships with park employees and drawing their attention to the rare plants on their site are critical to the long-term survival of that plant population. Park staff are often ideal local stewards once they learn how to identify the species and manage the population.

The value of the relationship with the landowners cannot be overstated and this relationship is most closely held by the volunteers assigned to monitor that population. The volunteers are cultivating the relationship and educating the landowner on the value of the species on their land and the methods for managing that population. This is something conservation professionals are not able to do alone on a regional scale.

Liability Waiver

Some landowners are comforted to know that all volunteers sign a liability waiver protecting the landowners from lawsuits should a volunteer have an accident while on their property. This document protects the landowner from responsibility if the volunteer should fall on a tree root and break an ankle or be bitten by a snake. One liability waiver can cover all projects carried out by that volunteer.

Training Content

Train your volunteers well with written materials, face-to-face meetings and field orientation. The New England Wild Flower Society holds annual training sessions in all of the New England states. The sessions are one-to-two day workshops with class presentations, hands-on field projects and project orientation as the volunteers choose their projects from a series of species-profile packages. Having a training manual in hand for the volunteer to refer to once he or she is alone with a project is imperative. New England was very kind in letting us use all of their training materials. Of course, we had to modify them for our region. In Georgia, our volunteer coordinator has held the training sessions a bit more informally and more frequently as she pieced together her network of volunteers. Heather would often travel to the volunteer's home and spend an evening going through the material at the kitchen table or would train a small group at a morning session at a local library. Often, in the beginning, one of the state botanists would accompany Heather and the volunteer into the volunteer's project site the first time, to point out the species to monitor and identify the threats to the natural population.

Here is Georgia's recipe for success: For each species and each site, prepare species-profile packages for the volunteers. Prepare these in the winter months before the field season begins. This timing requires that the Heritage Program botanists give their field assignments well before each season. Each species-profile package includes the botanical description and a drawing of the species, comparisons to other similar species, phenology data, herbarium label details, state element-occurrence records, landowner information and population location details, maps and a list of assignments for the season. For example, these assignments may be details on what phenological information to gather when monitoring the population or directions to pull invasive species from the site. Eventually, the package will also include GPS location details. Usually, the volunteer is collecting the first-ever GPS information on these rare plant populations.

During training sessions, don't overlook safety training. Volunteers may not have much experience in the field. Don't assume they know details about carrying water and food, a first aid kit and an EpiPen auto-injector to ward against anaphylactic shock if there is even the remotest concern with allergic reactions to insect bites. In Georgia during recent drought years, all Forest Service employees carried EpiPens with them into the field because ground wasps were unusually active. People without a history of allergic reactions to wasp stings can react after receiving multiple stings. Teach volunteers how to identify areas where wasps, hornets and snakes may live. Teach them as well how to identify, in all seasons, those plants in your area that irritate the skin. Show volunteers how to dress properly with long sleeves and pants, hats, closed-toed shoes and the highly fashionable pants-tucked-into-socks to combat attacks of crawling insects like ticks and chiggers. Teach your volunteers what to do if they get caught in the field during a thunderstorm. And when they are going into the field, have them give their family the volunteer coordinator's contact information in case of emergency.

Population Location Details

Teach volunteers to improve the population location details. We have all done this at one time or another: We have admitted that we can drive some place, but can't give someone directions there because we don't know the road names. Field location details can be sparse and a lot of time is lost as volunteers travel up and down the same road looking for that "turn off past the bend of the road by the county line and the railroad tracks." The volunteers should develop accurate driving and walking directions to their assigned site, writing details as if they had to get someone else to the site for the first time. Odometer readings, compass directions and now GPS data, are all essential. Details on how to walk into the site by using compass readings is critical. Identifying the site on quadrangle or other topographic maps is important. Mapping the plants within the population by hand through the use of line transects or whatever monitoring methods you prefer is also critical. And include within the population maps other details for orientation such as tree snags or other readily identifiable trees or large stones or stream courses. Volunteers can also be trained to walk around the population with a GPS unit, creating a polygon map of the site. The volunteers need to be trained in all of these details and have confidence in their mapping skills.

Tailoring the Population-Monitoring Data

Tailor the population-monitoring data for your local state Heritage Program. Before the first field report is produced, the volunteer coordinator should sit down with the state botanists and ask them how they would like the population data collected. Most Heritage Programs use standard element-occurrence (EO) data fields. Volunteers need to be well-versed in the EO record forms for their state and comfortable with all the terms they use. Filling out the data, as a state botanist would, will save time transferring the data back to the Heritage Program. In Georgia, we have a field report form for Botanical Guardians to use when monitoring that includes EO data. Heather then compiles the EO data for each species and submits the data to the Heritage Program electronically so that it can be imported into their database. The Heritage Program also receives a photocopy of each field report and photographic images of the monitored population for their files. In the future, perhaps we can loan volunteers laptop computers like a Trimble Recon with Bluetooth GPS and software like Trimble TerraSync so that volunteers can enter the data while standing in the field. Then a few steps could be saved by collecting the data electronically from the beginning.

Volunteer Coordinator's Responsibilities

Archive the Data and Set Up Reminders for Volunteers

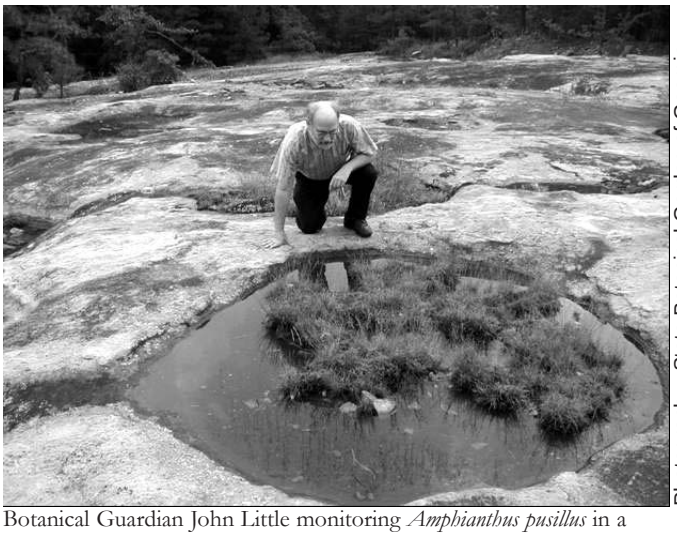
Archive the data at your botanical garden and get organized to prod volunteers with reminders. Use a filing cabinet to keep all your volunteers' original field notes, species-specific education packets, photographs, landowner details and project notes on file at your botanical garden as an archive of this project. Create a database of contact information for your volunteers and for your landowners. You may need to reach someone quickly and you don't want to waste time searching files. Also, to help track the details of your field projects, set up a database listing of all your projects by flowering season with dates listed for when activities must be complete. During the field season, mark your calendar with notes to contact your volunteers to remind them of their field tasks and then contact them again to check how the field work went.

Give Volunteers an Identifying Item

Give your volunteers some sort of item that identifies them as an official volunteer of your program. We give all of our Botanical Guardians a card to carry in their wallet that identifies them as part of our program and provides our volunteer coordinator's contact information. The card comes in handy when volunteers are first meeting landowners or state park staff. We considered baseball hats or T-shirts created just for our volunteers, but we realized there are times when volunteers want to be discrete about what they are doing when in the field.

Find Ways to Reward Your Volunteers

The New England Wild Flower Society offers a series of field trips, seminars, presentations and classes that are exclusively for their Plant Conservation Volunteers. Remember your volunteers are working with you for free on their own time and time is precious. Make the volunteers feel that they are part of a special inside group of the botanical garden and tell them frequently how valued their time and help are. Give them credit for their work in your publications and relay messages from state botanists of how valued their data are for conservationists making priority decisions. In Georgia, the volunteers have direct access to the conservation staff. When they contact the botanical garden, we make sure to stop what we are doing and pay attention to their needs. Heather also sends personal thank you letters and quick e-mail acknowledgments to volunteers during the field season



Photograph – State Botanical Garden of Georgia

Botanical Guardian John Little monitoring *Amphianthus pusillus* in a rock outcrop pool

and small gifts of appreciation such as conservation-themed T-shirts and books. An end-of-the-year party is a nice reward providing community to volunteers who have been in the field by themselves much of the time. It is fun to share images in a presentation as a kind of "Postcards from the Field" and encourage the volunteers to share stories of their field experiences. The volunteer coordinator will learn a lot during these sessions and will find ways for making the projects and the network more efficient.

NEWFS has paved the way for all of us by creating the New England volunteer network. The model is established and tested. Creating a network of volunteers for *in situ* plant-conservation projects is an efficient way to get a great deal of work accomplished each field season. Although there is inertia in the beginning as the team navigates the first few field seasons, the eventual return on the time and training invested is greatly amplified. The volunteers collect scientifically sound data. They can visit sites more frequently and consistently than overtaxed conservation professionals. They can provide expert assessments on the populations and take action if there is trouble in the population. Volunteers foster good relationships with private landowners, park staff and utility company employees who all interact with these endangered plant populations. Our Heritage Program botanists have evolved in their thinking from cautious optimism that volunteers could perhaps watch over a site and look for vandalism to relying on the expertise of our volunteers in the field to monitor and restore plant populations throughout our state. Our administrative staff report to our board of advisors and donors on all the good work our volunteers have accomplished, the number of populations rescued from the edge of extinction and adventure stories from the field that further endear this program to its background supporters. We all have come to rely upon our network of volunteers for their contributions and for the community they create with everyone whose lives are touched by the care of rare plant populations. In the end, by letting go and trusting one another, great things are accomplished.

Acknowledgments

I wish to thank Jim Affolter, Heather Alley, Bill Brumback and Linda Chafin for contributions to this chapter. I thank Anna Sher for the invitation to contribute to this publication. And I thank all the staff at Denver Botanic Gardens for their generous hospitality at the Applied Plant Conservation Training sessions I attended. I thank all the Botanical Guardians and the Plant Conservation Volunteers for their significant work on behalf of plants.

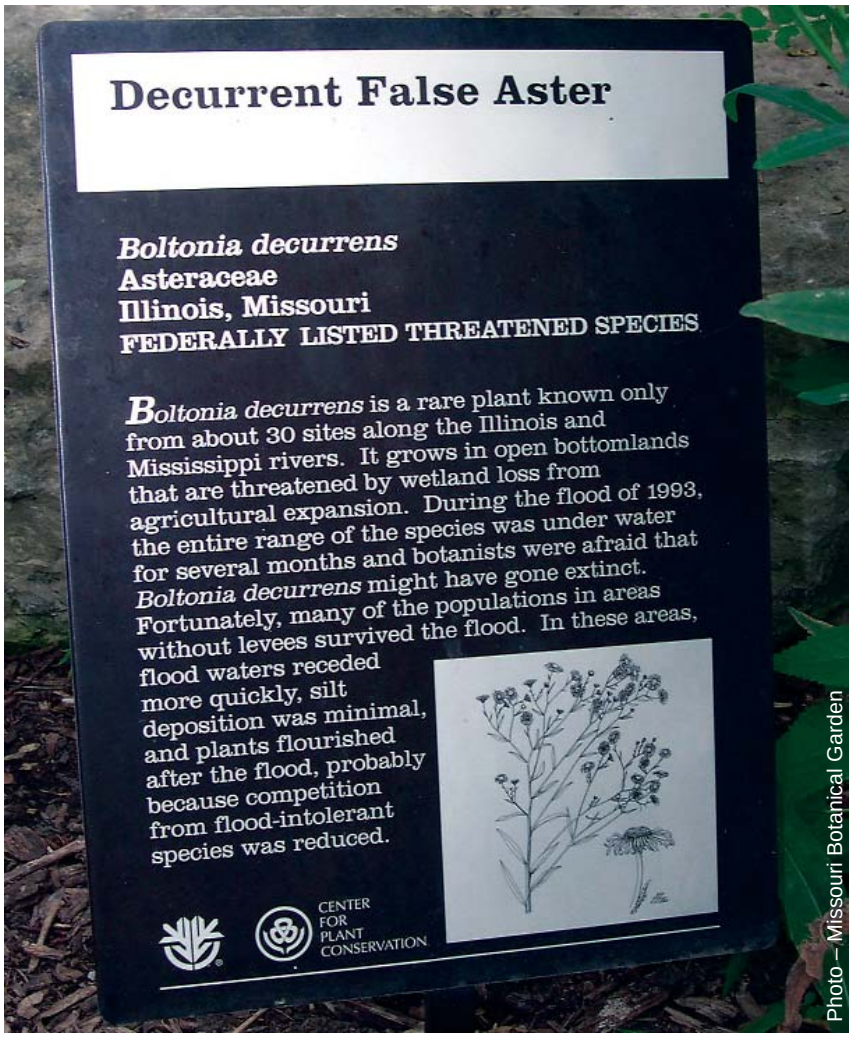
Conservation Messages Throughout the Garden

Kathryn Kennedy, Ph.D.
Executive Director, The Center for Plant Conservation

We've dealt with the importance of institutional commitment and support throughout the garden in building a successful conservation program. But a strong, productive conservation program busily engaged in hands-on conservation and restoration work is not the only way to contribute to conservation. Education is equally important and gardens are very good at education, particularly of elementary age children. But we know we have to do more.

Conservation Education as Part of the Botanical Garden Experience

Compared to reaching kids, educators at our Center for Plant Conservation institutions tell us that the older youth and adult audience is tougher to connect with in a measurable way. However, we need to communicate with the youth and adult audience to achieve our goals for conservation. We need to inform, engage and motivate older youth and adults because they are instrumental in supplying manpower and supporting funding and expanded programs to achieve more on-the-ground conservation work. They are the voters and near-voters in the community, so they are critical to good public policy for conservation. We need them to back adequate agency budgets that balance the importance of plant and animal conservation work. This audience can provide incentives, reasonable and appropriate legislation and regulations to protect our national legacy of native plant diversity.



Interpretive sign bearing the conservation message that the plant is a federally listed threatened species

SPECIAL PROGRAMS

- Provide evening, summer and weekend programs
- Organize a conservation lecture series
- Partner with conservation agencies for events
- Celebrate Earth Day, Endangered Species Day, Wildflower Week

Fortunately, a great many garden visitors fall into this vital group! Our garden visitors are generally well educated, curious and active and they like plants! They come to relax, they expect to get information about plants and they are ready to learn. They are great ambassadors and mentors to amplify messages to others.

MAKE THE CONNECTION TO SUSTAINABLE AGRICULTURE IN THE HOME GARDENING AREA

- Saving the wine industry in France with wild American grape stock when disease struck
- Okeechobee gourd's resistance to cucurbit pests
- The importance of wild types in plant breeding in your test gardens
- Economic or cultural uses of any local endangered plants

Gardens are wonderful places for life-long learning. Our institutions can take advantage of that and the curiosity of our visitors by including conservation messages directly and indirectly throughout the garden. Let's challenge ourselves to be leaders in sharing expertise, emphasis and information about conservation that our visitors will know is credible. How can we relay to them why plant conservation is important and what is involved in doing conservation work? We also need to let them know how they can make a difference in sustaining plant diversity.

Traditionally, most display gardens are dedicated to ornamental horticulture and vegetable gardening. Native plant gardens are another sort of gardening to consider because they present opportunities to interpret plants and teach about plants more broadly. It is a natural progression to add another dimension about native plants and natural areas to the displays and interpretations. A garden not only can be a beautiful place but also can teach a sense of place by focusing on what makes area landscapes recognizable, especially because of their habitats and species. Many garden visitors have a lively curiosity about local wildflowers, trees, communities and certain vulnerable species and the work that is done by institutions to restore them.

These topics can be presented through plantings, displays and photograph exhibits. This program element provides a natural tie to native plant landscape design, installation, resource use, plant recommendations and so forth for the home gardener, who will value the benefits of incorporating some of these plants into the home garden. You can help visitors explore both inside and outside the garden by providing reference materials on the local flora. Use entrance guide brochures and maps or materials for sale in the bookstore/gift shop. Partnering with your state parks

SHOW YOUR VISITORS HOW THEIR ACTIVITIES CAN MAKE A DIFFERENCE!

- Educate about and discourage use of serious invasive species
- Highlight invasive-species alternatives and participate in habitat restoration work
- Participate in Operation Budburst to monitor climate change
- Interpret predicted climate change in your area
- Include ways consumers can reduce carbon emissions
- Explain why enthusiasts collecting from small populations are a threat, especially for cacti, orchids and medicinal plants
- Point the way to responsible sources of cultivated stock

BE A FACILITATOR FOR CONSERVATION

- Bring the conservation audience to the garden
- Invite the native plant society to meet at the garden
- Invite conservation agencies to use your meeting space
- Organize symposia about rare plants, invasive plants, etc
- Give an environmental award in your community
- Sponsor a native plant garden award

or department of natural resources to give the visitor a taste of natural areas has led to a good visitor response in many institutions.

Even if you cannot dedicate display and interpretive wall space to a general overview of habitats, native plants and endangered plants of the area, there is still a great deal that can be done. Conservation information can be included directly and indirectly in many ways in any institution.

The motivations of the visitors in coming to the garden are, sadly, seldom because they have a burning passion for conservation. They may not even think they care about conservation. They come for a variety of reasons and those desires need to be addressed. How can we take advantage of the visitors' path through the garden and participation in garden activities to demonstrate how vital and interesting our work is? We need to find ways to include conservation information and emphasis throughout the garden. We need to offer experiences and information that get our visitors thinking about conservation in many different ways and encourage them to learn more and to share what they learn.

POPULAR LITERATURE IN YOUR GIFT SHOP

- *America's Vanishing Flora* (Center for Plant Conservation)
- *Alien Invasion* (Robert Devine)
- *The Forgotten Pollinators* (Buchmann and Nabhan)
- *Last Chance to See* (Adams and Carwardine)
- *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*(Richard Louv)
- *Something New Under the Sun* (J.R. McNeill)
- *Remains of a Rainbow* (Middleton and Littschwager; this is a photo book on Hawaii)
- *Plants in Peril* (a Center for Plant Conservation guide for educators)
- State rare plant guides
- *Children's titles!*

SUSTAINABLE PRODUCTS IN YOUR GIFT SHOP

- Treeless paper
- Recycled paper
- Carefully tagged propagated plants
- Merchandise with postconsumer recycled basic materials
- Shade-grown coffee
- Endangered species note cards and chocolate

COMMUNICATIONS

- Put a conservation column in your newsletter
- Write a conservation column for your newspaper
- Set up your Web site as a resource on the local flora
- Provide a gateway of links to other resources
- Put a specimen collection online for the public to identify native plants
- No sensitive locality information please
- Link your Web site to the Botanic Gardens Conservation International Web site
  www.bgci.org
- Link your Web site to Plants in Peril, an invasive species Web portal and Conservation Directory on the Center for Plant Conservation Web site
  www.centerforplantconservation.org

Many of us are not educators or interpretive designers. We will need expert help. This is an area in which the support of the administration and leaders of the garden and your good relationships with other departments can really pay off. If your colleagues and bosses know that conservation information is interesting, even compelling and can be tied back to a visitor's daily life, I think they will be open to working with these concepts.

With the help of staff in various departments and the support of the administration, there are almost limitless possibilities for formal and informal conservation education. Some institutions do a number of creative and apparently effective things within other departments and activities.

We can be facilitators to help get the process started, but becoming a garden dedicated to broadly integrating

EDUCATION

- Create a Web page with links to resources for teachers about endangered plants, invasive species, sustainability and local vegetation change from climate change
- Link to the national environmental education site
- Interpret national and international endangerment
- Highlight levels of loss or concern for wild species at shows
- Present conservation issues regarding orchids, cacti, African violets and other popular plants and highlight work being done to secure and restore them
- Provide consumer tips for how to help conserve "wild" house and garden plants (propagated plants, etc.)
- Talk about how invasives move in the landscape and why you don't use them in the wreath-making classes
- Teach Scouting conservation merit badges
- Give special behind-the-scenes tours of conservation work areas
- Offer classes in native plant identification as well as design and gardening
- Offer a speakers bureau for classrooms; train volunteers and recruit universities

conservation information into operations takes support from the top and from within. Remember though that every idea is not going to work for every venue in the garden. The activities chosen should be effective and should be a good fit for the mission and managers of that area or activity. If we also get our educators and other expert staff engaged, I'm sure we can succeed.

Promoting Conservation in the Garden; final thoughts

I do not have the training to take us further than articulating the challenge and noting some observations I've made in travels across the country. There are some obvious questions that will help us think through how to proceed. There are also some ideas to share to get a conversation and some brainstorming started.

ADMINISTRATIVE SUPPORT

- Develop an institutional invasive-species policy and tell your members about it in your newsletter
- Find a sister garden to assist in another country
- Provide garden-wide recycling opportunities

A good consumer profile of our visitors should help us target our efforts. What do we know about our visitors? What do they care about? Why are they here? How much time do they have to invest? How long does it take for them to absorb a message? A visitor survey to see how informed your community is would be both instructive and helpful before you initiate efforts to educate visitors about conservation. Someone in your institution may be able to help you design a useful survey and you can facilitate getting it done with your manpower and organizational skills.

What sorts of activities and venues are available at the garden? Most of our institutions have beautiful horticultural display areas, home gardening areas, perhaps a children's garden, native plant or wildflower garden and in some cases, natural areas. Many have gift shops and cafe's. Most have classes and special events or allied organizations with a specialized focus, for example, cacti, camellias or orchids.

One suggestion to include a conservation message is to find a way to label specimens in your collections that are declining in the wild (e.g. see Chapter 6). This can be done without endangering the security of really valuable specimens. You could consider examples of orchids, cycads, palms, gesneriads and so forth. Find a spot to interpret why the plant or a related plant is imperiled. You could make the interpretation into an explorer activity with a checklist.

How can conservation information be included appropriately and effectively? Ideas from many institutions are presented here. I hope that you enjoy brainstorming and sorting through them and that they provide a basis for discussions within your own institutions.

Chapter 6

Interpreting Plant Conservation

Christine A. Flanagan, Ph.D.
Public Programs Manager, The United States Botanic Garden

Photograph – Scott Dressel-Martin

Applied Plant Conservation Training Program participants take an interpretive hike on Mount Goliath's M. Walter Pesman Trail

Interpretation in an educational setting is the act of promoting *understanding* or *telling the meaning of* a place, object, event or process. Interpretation may involve a mix of facts and other information in text form, graphic illustrations, photographic images, sounds, odors and/or various forms of electronic media. Good interpretation shares some features of storytelling: *explanation* and *analysis*. An individual recognizes good interpretation when he/she encounters it; the converse is also true. Bad or ineffective interpretation tends to stimulate frustration or loss of interest. Not surprisingly, curators or agency chiefs are often the poorest judges of the quality of the interpretation they create. One may surmise that they are too close to the subject matter. Synonyms of interpretation include *reading, construal* and *version*, words that hint at some of the pitfalls. Creating good interpretation is not easy.

This paper provides some basic guidance for those who are new to the work of interpretation, particularly for those who receive the assignment as an "add-on" to their other duties. Throughout this paper, I use "project" to refer to what is being interpreted. Essentially, the steps I discuss are similar whether the project is relatively simple and circumscribed, for example, restoration of a plant population at one site, or very complex, for example, a multisite public-private partnership to control the spread of invasive species. A "visitor" is someone who comes to your site (booth, display or even Web site). "Receiver" refers to anyone external to the project who will experience the interpretation and "audience" refers to the heterogeneous group composed of subsets or categories of visitors.

Gain Perspective on the Interpretive Process Ahead

Typically, once a decision has been made to interpret a project or site, it is helpful to start with some "soft" boundaries regarding available funding, time and location. These may emerge through a preliminary study or through management decisions — either way, they provide a valuable framework for the interpretive team. Ideally, the work proceeds through the accompanying logical series of steps. The work is often iterative, involving testing of approaches, problem solving and retesting before a final plan and design are implemented.

Embrace the Process of Doing Interpretation

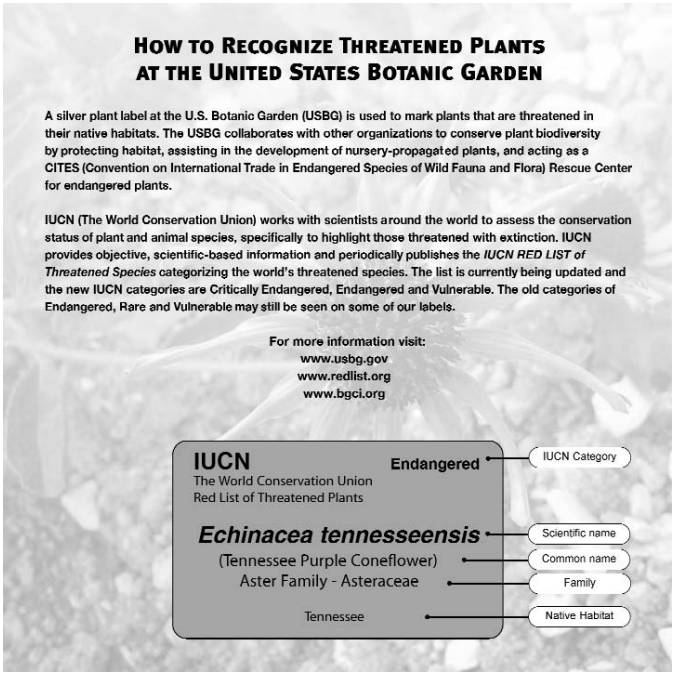
Granting agencies, a donor or a regional chief may require that you do interpretation, your citizens' advisory group may want to do it, or you may think interpretation will reduce staff distractions caused by inquisitive. Although these may be proximal reasons, good interpretive efforts ultimately are about believing in the work of your institution and its mission and valuing the opportunity to educate others.

Understand What You Want to Achieve

Meet with the agency manager, project manager, key "approvers" and other stakeholders to hear them state in their own terms what they want the visitor to know and learn, how they hope the visitor will feel about the information and what they want the visitor to do with the information. Analyze these interviews carefully and translate the ideas into simple goals, objectives and messages. If at first you can't make them simple, keep working until you can. Conflicting messages often emerge in this process; it is important to resolve them before you proceed further. This effort often requires careful use of words, a dispassionate appreciation of differing perspectives and patience.

STEPS TO A SUCCESSFUL INTERPRETATION PROCESS

- Front-end evaluation (what does my audience already know?)
- Development of the plan, key concepts, content and delivery mode
- Formative evaluation (prototyping — or, "will this work"?)
- Design and review
- Fabrication
- Installation
- Summative evaluation (did we achieve our goals?)



Don't Assume That You Will Produce Signs

Ask, how is my audience best engaged? Interpretation may take many forms. Remember that visitors are of different ages and learn in different ways, so consider utilizing more than one mode of information delivery. Signs with text and graphics have appeal to one subset of visitors; other subsets will gravitate toward discovery stations, engaging interactive devices, multisensory experiences, media, guided tours or games. Remember, too, that visitors are taking in perceptions about your site or project from many sources. Your Web site, parking lot, entrance experience, brochures, directional signage and pathways all contribute context before a visitor encounters your first interpretive offering. Are they presenting a consistent message? If your project is about restoration of native plant communities, don't plant impatiens in the beds around the parking lot.

Getting Started

The first step is to understand the project that you are going to interpret: what is the objective? How will success of the project be measured? What is important about this project, at this site, at this time? Interview the on-site researchers, project managers and other project stakeholders. Read the project proposal and interim reports. Visit the project site and ask questions. Take notes.

Next, work with your team to process the information: identify key words and concepts; make concept diagrams that show how all the ideas relate to each other; identify areas of confusion or difference among the interviewees and note ideas that are too complex or abstract to make tangible.

Use this information to answer basic questions about the interpretation: What is the most important idea for visitors to take away? What are the structural concepts that build the framework for understanding the idea? What are the key objects, plants and images that tell the story? How will you know you have achieved success? With these answers in hand, you are ready to form your interpretive plan.

Applied Plant Conservation Training Program participants visit the Dos Chappell Nature Center and Interpretive Site on Mount Goliath

Establishing the Boundaries: Goals, Objectives, Messages and Big Ideas

Create Goals and Objectives

Squelch any urge to start thinking about specific signs. Instead, create a set of goals and objectives for your interpretation. Avoid being overly ambitious. Depending on the size of your project, you may want to set only two or three goals, each having no more than two or three objectives, each of those followed by a few specific messages. If your project is large with well-defined and separate areas of work, you may develop goals for each focal area. For example, restoration of a mining site might involve soil detoxification, reestablishment of a native plant community and monitoring effects on the watershed.

Ways to Develop the "Big Idea"

Once you have gained approval of the goals, objectives and messages, you are ready to work on the "big idea" that you want to convey. *Your big idea sets boundaries and dictates the context surrounding your interpretation.* Your big idea describes in a simple declarative statement what the visitor could glean from surveying your interpretive exhibit. It also serves as a complex concept that connects your goals, your site and your institutional mission.

To see how this phase of the process works, suppose your project is restoration of the natural plant community and habitat on a conservation trust site near a city. Besides telling the story of the restoration, the stakeholders want the message to encourage visitors to be better stewards of the patches of environment around their homes and businesses. Goal A is "Encourage citizens to plant native plants." Goal B is "Empower citizens to practice conservation-wise gardening." Specific objectives for Goal A include (1) familiarize the visitor with the concept of native plants and give local examples and (2) identify reputable practices governing the commerce in native plant species. Consider these two options for the big idea that captures your interpretive goals:

Option A — "Native plant gardens are beautiful, practical and sustainable." Visitors would see examples of native plantings (and/or photographs of plants in gardens) and the signage, text and discovery stations would show native plants that are available to gardeners from reputable sources *and no others*. Featured plants would vary in phenology, color, texture and form and be suitable for sun, shade and various exposures.

Option B — "Your garden is connected to the surrounding ecosystem." This big idea would suggest use of natives as well as ornamentals, in a mixed garden setting. It would feature plants that support wildlife and pollinators. However, ornamental cultivars devoid of nectar or pollen rewards or that are nonfruiting would not be appropriate. The displays would also reflect issues of local importance (e.g., drought-tolerant plants in an arid region).

Remember that your audience is drawing upon the subtle cues and context that you have provided — therefore, beware of sending contradictory messages. For example, both options prohibit using native plants that your project team has grown from wild-collected seeds, volunteers have rescued

QUALITIES OF AN EFFECTIVE BIG IDEA

- It sets boundaries
- It suggests a look and feel
- It can be very simply stated
- It is appropriate and works well in the site in which the interpretive elements are presented
- It resonates with the audience

from development sites or supporters might donate from their property, *if those species are not available in the trade*. Both options suggest the use of plants that don't require chemicals and aren't invasive. Both options accommodate the two objectives. Option A suggests activities and examples that focus on native plant gardens that are healthy and sustainable (e.g., integrated pest management — IPM, organic methods and drought tolerance). Option B leads to wider plant selections and suggests activities that focus on plant-pollinator interactions, IPM, organic methods, linkage to natural plant communities, natural pollinator populations and the watershed.

If your project has sprouted from a robust vision or mission that guides your institution, your big ideas may precede elucidation of the goals and objectives. Either way, they all must work together in the interpretation.

Set a Timeline

If your time for completion of the interpretation project is limited, acknowledge the time frame from the beginning. Allow time for writing, researching, evaluating, revising, designing, contracting, procurement and fabricating. Allow for delays. Consider a plan that calls for phased interpretation and identify intermediate goals; include evaluation in each phase.

Front-End Evaluation

Are your goals, objectives and specific messages appropriate? Only your audience knows! Conduct research to find out how much they already know about your topic. If your interpretation team does not already have strong experience with engaging your audience, this evaluation is all the more important.

Front-end evaluation requires you to interact with your audience. If your audience is not already present at your site, find a suitable local venue that would attract a similar audience. For each goal and objective, develop a small set of queries consisting of a few open-ended questions, a few yes/no questions and a few multiple choice questions. For example, after a potential member of your audience gives you permission to interview, your opening question might be, "We are planning an exhibit about native plants. What do you think a native plant is?" A follow-up question might be "Can you give me an example of a native plant?" Include questions to probe for any "misinformation" or misconceptions that you suspect may need to be addressed in your interpretation. Also ask pertinent questions about their background and general familiarity with plants, environmental issues and/or gardening.

You may also want to test audience sensitivities to concepts or vocabulary relevant to your goals that may be at issue in your area (e.g., evolution, "native," all-terrain vehicle use, grazing rights or endangered species). You might end with a question about the interviewee's level of interest in the topic you have been discussing. Include a demographic "snapshot" of each respondent (e.g., age range, gender, home zip code, educational level and ethnicity). Plan to interview at least 50 people, more if your audience is highly diversified.

Answers to these questions can then be compared to your goals, objectives and specific messages. Sometimes, the results indicate that you have misjudged significantly the sophistication of your audience and therefore you have to rethink your plan. More typically, you may find that you have to fine tune some concepts or reject some of the messages or vocabulary. If your project has been years in development, beware of relying on data more than three years old. Media outlets such as cable television and the Internet have vastly increased access to a wide range of options in education. Community demographics are also changing rapidly. Use your demographic data to compare with previous audience measures.

Concept and Content Development

Your project scientists are your curators, that is, they will suggest the concepts to address the goals and objectives and they are the experts who select specific objects, animals, plants, images or activities that tell the story. However, scientists and curators often need to be tempered by the interpretive team. More information is not necessarily better. A skillful interpretive team will use nontechnical language and simple examples that aren't confounded by socioeconomic or culturally based interpretations. Layer the information pertaining to each goal so that visitors can choose to dig

down into topics they are interested in and proceed at a more superficial level for topics of marginal interest. When writing sign text, avoid long paragraphs; instead, provide "chunks" of information interspersed with graphics or objects. Visitors will often commit to reading one chunk and then are beguiled into reading more of them.

Formative Evaluation

Once you have settled on a plan, you are ready to write and design. Does one headline work better than another? Is one example clearer or more interesting? Is one kind of label or image better than another? Is an empathic approach better than an intellectual one in getting an idea across? What will kids do with it? Again, only your audience knows. Take a simple prototype for a sign or activity out into your visitor space and watch as they interact with it. Their feedback will quickly expose flaws, misconceptions or safety issues you might inadvertently create. This experiment is also a good way to resolve competing proposals among team members for activities and approaches.

As for how to deliver a message, text on a sign is often less effective at communicating a complex concept than other forms of sensory stimulation. Words cannot replace real objects that may be touched or held — petrified wood or a plant fossil make real the geologic history contained in a chart, for example. Odors or fragrances often bring to the surface vivid memories stored many years in the past and stimulate both emotional reactions and deep associations with time and place.

ACTIVE VS. PASSIVE INTERPRETATION

Sender initiates	Receiver initiates
• People interact	• Visitor interacts with object
• Tours, carts, object programs	• Signs, videos, props, etc. - may involve interactive components, e.g., flips, slides, wheels
• Visitor services props, etc.	• Like fishing
• Staff, volunteers, peers	
• Training is key	
• Personality risk	

COMMON PITFALLS

- **Too much to read:** Say it simpler, shorter and sooner. Make your words work hard and use fewer of them.
- **Sending mixed messages:** Actions and context speak louder than words.
- **Getting blindsided:** Do your homework. Don't ignore possible controversy. Be prepared to be challenged.
- **Misjudgement of audience:** Are you interpreting for the visitors you have or the audience you've been assigned?
- **Blurred vision:** Your big idea sets the boundaries. Beware of late ideas or suggestions that soften the boundaries.

For example, photographs reproduced to look like postcards and mounted as if they were on a postcard stand stimulate visitors to stop and peruse them. The subliminal suggestion is "these are all different but yet they are all related." The activity of looking at the postcards, comparing one to another or flipping them to see the backsides, taps into an experience familiar to people of a wide range of ages and backgrounds. The opportunity to look at the postcards encourages the visitors to actively search for information and rewards their curiosity.

Text will inevitably be involved. Use colorful language and alliteration. Avoid technical terms, long sentences and long paragraphs. Remember that your visitors have short attention spans and have been conditioned by the media to expect quick delivery. Pique interest with the unexpected. Pay off curiosity.

Whenever possible, find ways to present a concept by engaging the visitor in something other than, or at least in addition to, reading. Low-tech and simple are preferred to high-tech and complicated, especially if you expect your installation to endure several years with little or no maintenance. Interpretation that requires hardware (e.g., audio tours that use personal digital assistants — PDAs) run by software is doomed to obsolescence of both systems. For that reason, cell phone tours are seen as a way of controlling audio (and possibly video) content while transferring hardware costs to consumers and software costs to developers.

Early in developing your interpretation plan, decide the mode of presentation for each of the objectives and messages.

Develop a list of discovery stations, objects to obtain, videos to be created, tours to script, plants to obtain and other resources that will be required. Some objectives will be delivered in several ways. Throughout the development of the plan, continually check against the big idea. Deviations from or inconsistencies with the big idea lead to blurring of the presentation in the mind of your visitor. Be discriminating about suggestions you receive from interested parties to avoid introducing "static" in your message line.

Design and Review

Proofread all script, signs and captions and then have two others do it again. Try to find someone who is unfamiliar with the project to proofread your final script and your sign designs. And don't assume your fabricator won't make mistakes. When your final products arrive, compare each carefully to the final designs. Colors change, text doesn't flow and images get transposed — it is better to discover these problems before the signs are installed.

The Interpretation Team

A writer, a project manager and a design team work closely with the curator of the exhibit. The curator (or curatorial team) is responsible for the intellectual content and accuracy of what is presented. Although these roles are somewhat circumscribed, the role of the team leader is less well defined. The leader holds everyone responsible to the big idea and articulates, as often and in as many ways as necessary, the vision for the project. Ultimately, each person will contribute in the form of content, design, script, objects and so forth their own understanding of the big idea. The look, feel and quality of the final product are a reflection of this process and the ability of the leader to communicate and inspire. A leader is more than a project manager, although in small teams, one person might do both jobs.

VISION FOLLOWS A CRITICAL PATH

- Leader is keeper of the vision and big idea
- Designer (makes the vision real; begins with the layouts and drawings)
- Content specialists (meaning makers and knowledge keepers)
- Writers (accessibility keepers)
- Exhibit fabricators, installers and personnel maintainance

Every team will benefit from skilled support staff that can prepare prototypes and surveys, process data and act as conduits for communication and record keeping. If you borrow images or objects, be sure to maintain spotless records of sources and signed forms granting use and return of images after the project is concluded.

Whether you use a design consultant or an in-house designer is largely a matter of staff time and funding. A confident and knowledgeable interpretation team will work well and efficiently with an in-house designer, particularly if the designer has a past record of flexibility. An inexperienced team may benefit greatly from working with a well established firm used to the local climate and audience. Don't hesitate to ask peers from other institutions for a recommendation or advice about consultants they have used.

Know Your Audience

Most interpretive decisions are related to the kind of audience you serve, as well as the kind you seek to attract. These may or may not coincide. Visitors can be characterized in many ways. For example, quantitative and qualitative data might include age, gender, ethnicity, race, socioeconomic and/or cultural background, zipcode, educational level, native language, country of origin, reason for visit, psychographic characterizations, or occupation.

What audience do you most want to reach? If this audience is not already a large component of your visitors, then stop and carefully examine the reasons for the inconsistency. You may have a fundamental marketing problem, or your overall project may not be realistic. If your audience is the general public who visits your institution, incorporating the results of the front-end and formative evaluation should assure that your interpretation will be effective. There is no substitute for knowing your audience.

If your institution does not host the public, then your audience may vary. This situation is especially challenging for the interpretive team because the context of the interpretation and the makeup of the audience are not under your control. In this context, note that portable presentations are most effective when they are issue specific and accompanied by notable objects and activities.

Audience vs. Receivers

Anyone who experiences your interpretation is a receiver of the information you are providing. Receivers may be, but are not necessarily, the same as your audience.

Feedback on interpretation often comes freely from stakeholders, but should not be confused with feedback from your audience. Stakeholders are likely familiar with your project and thus may be biased receivers. Bias may stem from disagreement with the interpretation goals or messages or from a desire to deliver messages that are exterior to the big idea.

AUDIENCE VS. RECEIVERS

Audience	Receivers
• NOT yourself (often forgotten)	• Administration
• Must choose a primary audience, e.g., families	• Board of directors
• Can augment for second audience, e.g., middle school students	• Volunteers
	• Funders
	• Staff
	• Anyone experiencing your interpretation

By definition, stakeholders' opinions originate from a different perspective than that of either the interpretation team or the audience. In the face of both applause and criticism, it may be difficult to remember that once your interpretation plan is approved, the feedback and evaluation that best gauge your success come from the intended audience. This feedback requires a concerted effort to gather and analyze.

Final Thoughts

Remembering a few guidelines will assist you in creating effective interpretation.

Tell your visitor what you want them to know. Don't assume they will deduce it from your presentation.

Make sure your images or objects reinforce your messages. Images should be eye-catching and work on several levels to convey the information you think is important.

Don't expect any one interpretive device (sign, cart, sculpture and so forth) to do everything. Redundancy in message and diversity in form make a good combination.

Simple is almost always better.

A good headline or title speaks volumes and sets the tone for the rest of the experience.

Don't write or interpret for those who are already educated about your topic.

Unless your site is unidirectional, don't assume that your visitors will experience the interpretation in a given sequence. Presenting interpretation that builds upon itself is risky.

Assume that visitors may miss key points. Remember, your efforts are directed toward achieving your goals with the majority of visitors. A subset of visitors will also absorb the specific messages.

Plan time in the project schedule for "thinking on background". Giving ideas and impressions time to settle is important. If something is nagging for attention after a decision is made, pay attention to it. The subconscious is your ally.

Finally, don't be timid in your approach. Interpreters of plant conservation — like the scientists and horticulturists they represent — can draw motivation and energy from a sense of urgency related to a fundamental fact: *Life as we know it is made possible by plants.* Most people do not respect plants as life forms and certainly don't conduct their lives or make decisions (or vote) as if their lives depended on plants. Human societies can no longer afford to be disconnected from the natural systems that support us. Interpretation of plant conservation is important work!

Selected Resources

A wide range of publications and resources are available at the National Association for Interpretation Press (www.interpnet.com/publications/interppress.shtml) and the American Association of Museums bookstore (aam-us.org/bookstore/). Excellent sources for vendors, materials and ideas for approaches to building include Sign Builder (www.exhibitbuilder.com) and Exhibit Builder (www.signbuilder.com).

Professional Journals

Legacy, National Association for Interpretation (published bimonthly).

Public Garden, American Association of Botanical Gardens and Arboreta.

Museum News, American Association of Museums.

Books

Roberts, Lisa C. "From knowledge to narrative: Educators and the changing museum" (Washington, D.C.: Smithsonian Institution, 1997).

Brochu, Lisa. "Interpretive planning: The 5-M model for successful planning projects" (Fort Collins, Colo.: National Association for Interpretation, InterpPress, 2003).

The American Association of Museums hosted a 2005 workshop on Standards and Best Practices for Interpretive Planning (see the AAM Web site).

Serrell, Beverly. "Exhibit labels, an interpretive approach"(Walnut Creek, Calif.: AltaMira Press, 1996).

Interpretation in the Garden

Maximizing Your Message

Celia Curtis
Public Programs Manager, Denver Botanic Gardens

Photograph – Scott Dressel-Martin

A colorful and informative sign draws visitors into Denver Botanic Gardens' Water-Smart Garden

What Is Interpretation?

Interpretation, *noun.* Establishment of meaning: *an explanation or establishment of the meaning or significance of something.*

Freeman Tilden, author of "Interpreting Our Heritage", defines "interpretation" as an educational activity that "aims to reveal meanings and relationships through the use of original objects, by firsthand experience and by illustrative media, rather than simply to communicate factual information" [Chapel Hill, N.C.: University of North Carolina Press, 1977, p. 8]. Tilden further writes that "information is not interpretation" and that "the chief aim of interpretation is not instruction, but *provocation*."

In other words, the most important thing to keep in mind when developing interpretation in your garden is this: you want to provide just enough information and ask just enough questions to pique the visitor's interest in a meaningful way and help them to connect on a personal level with the exhibits. You do not want to tell them everything you know! If you are doing your job well, the visitor will leave wanting to know more. Rather than feeling thoroughly informed, they should leave feeling thoroughly curious and inspired.

"I believe just one bad label can turn people off to a whole exhibition. When I'm tired of writing and find myself saying, "Just write any old thing and be done with it," I remind myself that this might be the very first label a visitor will read. If it's badly written, it might very well be his or her last."

— Judy Rand, exhibit developer

"In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught."

— Baba Dioum

According to Chandler Screven, interpretation is influenced by several factors. The first is the content of the sign or label. Content can refer to the text and its message, questions or instructions directed at the viewer and emotional components in the message. The visual structure is also important. How legible is the text? How is the information organized on the label or sign? Colors, style and the density of the information all play a role as well. Presentation format affects the visitor — is the information presented on a wall label? A touch screen computer? A video in a small theater? Through an audio tour?

Finally, the physical context of the visitor experience has tremendous impact on the visitor's ability to engage in and absorb information (and to retain it!). A host of factors contribute to the physical context: noise, lighting, competing exhibits, entrances and exits, other content in the exhibit and even children (who may be bored or agitated), lack of a place to sit, the need for a restroom, hunger or thirst and more.

When developing interpretation, it is useful to consider all of these factors. They may seem unrelated to the content at hand and how you should deliver it, but they will be an immediate component of your visitor's experience. Careful attention to how your interpretation will (or might) function under these complex circumstances can only improve your message and how you organize content.

Where to Start?

The relationship between word and image or object is central to museum interpretation and applies to gardens as well. Begin with what's in front of you (the visitor). What do you see? A public garden, museum exhibit or other interpreted display establishes a relationship between the words and the image, object or plant. The words must relate to the exhibit. They must also relate to the visitor and connect directly with the visitor's experience at that moment. What would you want to know first? What would catch your eye? This is where you want to start and you don't want to go far beyond this point. Keep the content within this intimate sphere, where what you are talking about relates directly to the visitor's experience, values and interests. Remember, you want to provoke. If you do your job well, your visitor will proceed to find more information on the Internet, in a bookstore or at a garden center. This does not mean you've provided too little information; it means you've lit a spark!

As an example, consider a sign in a garden of South African plants. One way you could start off the text would be to describe South Africa and its environment and launch into a description of its plants, perhaps with a map or some photographs. But what if the visitor reading your sign has never been to South Africa? You've already left her far behind; either she's interested in South Africa, or she's not. But what you do know is that she's looking at your sign and looking at the plants in front of her. So start there. Reference the plants in front of her. How have they adapted to their environment in your garden? How is that environment similar to the one they came from? Before you know it, you've communicated a great deal of information about South Africa and you've done it in a more personally engaging manner than you might have.

Photograph – Tad Lusk

Effective signage holds visitor attention while also blending into the surrounding environment

Content

All interpretive programs need to use criteria for deciding what information to present. These criteria will also help you to decide what information NOT to present. At Denver Botanic Gardens, interpretation flows from a master plan of interpretive themes and goals. Anything that falls outside of these defined-content messages is not included. Another useful way to limit your scope is to develop an exhibit "story line." Every component of the interpretation should adhere to the content messages outlined in this story line and must correspond to the proposed theme.

It may help to bear in mind that visitors are able to remember much more if the content they view is presented as part of a theme, rather than as several unrelated pieces of information. If everything they look at contributes to a clearly stated big picture, this framework will travel safely through the gardens in your visitors mind and allow them to populate it with interesting facts and details along the way.

Word Count and Layout

A useful acronym for the interpretive writer is KISS — Keep It Simple Stupid! To support this rather simplistic notion, studies have actually proved that less is more when it comes to exhibit text. In exhibits with fewer and shorter text panels, it has been shown that visitors actually read more of the text (and more text quantitatively) than in exhibits with long, text-heavy panels. The sight of too much text can really put people off the notion of reading. It's too daunting to even start. A little bit here and there, however, is much more inviting. You stand a better chance of communicating more of your message if you present it as sparingly as possible.

At Denver Botanic Gardens, we limit our smaller, temporary interpretive signs to 100 words each. Larger permanent panels, or introductory panels in a special exhibit, may have 150 to 200 words. In most cases, the latter combine words with graphics such as maps or photographs to break up the blocks of text and make it appear as though there is less to read.

Other techniques to break up the text include using sidebars and creating short paragraphs with headlines rather than one long paragraph. You can also place some of the content in captions alongside photographs rather than in the body of the text. If you can make the same point with a picture, graph or map — do it. Many more people will understand you, they will understand you faster and your sign will look much more interesting to boot, drawing even more people to read it in the first place.

We sometimes use smaller signs (5 × 7 inches) to sprinkle bits of information or questions throughout the gardens. These bite-sized facts or questions (in the case of our audio tour markers) are read by the visitor before they even know it; there is no need to decide whether or not to approach that text-covered panel to see if it's worth reading.

Writing and Editing

There are many excellent resources for writing good interpretive text. Helpful hints and techniques for editing content and shortening the word count in labels can be found in several handbooks on developing museum exhibits, most especially "Writing Exhibit Labels:" by Beverly Serrell and "Planning for People in Museum Exhibitions" by Kathleen McLean. Serrell suggests many useful editing tricks to ensure both a simple, concise style and maximum readability for various age levels.

The editing tip I talk about the most is to eliminate passive voice. Many people, especially those with college and graduate degrees, are far too prone to write in the passive voice. This is a terrible habit held over from writing academic papers, where long, convoluted sentences that obscure the real story and add unnecessary length were ideal. In the museum and botanic garden world, however, obfuscation is the opposite of what you are looking for. You want to convey your message by the simplest, shortest means possible, even if you don't think this approach makes you sound nearly as educated and cerebral as your beloved passive constructions. I always insist on eliminating all passive sentences, unless a label simply will not work any other way. This single change contributes a surprising reduction in word count without losing a single bit of content.

Eventually you will learn to love writing only active sentences. They are short, elegant and strong. They always have an agent, which means something is always happening and that's much more interesting than having things happen to you or to your plants! You may even find your sign texts resonating in a rather poetic way; there is beauty in brevity. Your visitors will love you for it.

Accessibility Factors

Because of the Americans with Disabilities Act, everyone knows that they need to make their signage and interpretation conform to standards for accessibility, but they aren't always sure where to find those standards. To make matters more confusing, the standards can vary depending on where you look. Good resources for museum and wayside signage are plentiful.

FONT SIZES, LEVELS OF CONTRAST, LABEL OR SIGN HEIGHT, ADA REQUIREMENTS FOR ACCESS AND MORE

- The National Park Service Harpers Ferry Center has a PDF document on their Web site called *Special Populations: Programmatic Accessibility Guidelines for Interpretive Media*. It lists standards for both signage and printed materials such as brochures.
- The Smithsonian Institution provides a thick manual of exhibit standards as well as an accessibility checklist that helps you evaluate all aspects of your exhibit setting.
- The American Association of Museums publishes a standards manual that was first produced by the Metropolitan Museum of Art.

ANOTHER USEFUL RESOURCE

- The Center for Universal Design at North Carolina State University has a Web site listing the Principles of Universal Design. This is a list of very useful general considerations for all designed environments and products. On a very basic level, following these principles (such as tolerance for error) will help you optimize your learning environment for as many users as possible.

Although in many cases the exact measurements and standards vary between sources, they all cover a minimum acceptable range. For example, one may say that wall labels should be no higher than 72 inches whereas another says they should be no higher than 67 inches — but if you err on the side of caution and choose the more conservative figure, you will always fall within all listed standards. Or if you mount your labels at 69 inches, you could take the position that you are falling acceptably close to both standards — at least you will know that you're in the right ballpark and that knowledge will help you design a more effective and accessible exhibit or sign.

Solid Construction

Because of the outdoor location of our exhibits and Colorado's severe weather, durability is a factor. Our signs are designed and constructed to last a minimum of 10 years. Realistically, you should seek out materials and fabrication methods that will give you at least five years of good use without substantial fading, cracking, peeling or other wear.

Physical construction includes not only materials, but installation — height, angle, how it is secured in the ground and so forth. Consult sources for standards on height, angle and size of wayside interpretive signage. There should be no sharp edges that could injure young heads. Construction materials and display angles should be chosen to avoid glare, fading, snow accumulation, bird droppings, chipping and scratching. Anchoring systems should combine ease of installation and removal with resistance to weather, vandalism and sudden impact. Signs should feel and appear secure and permanent, not flimsy.

Outdoor Considerations

The most important factor that affects outdoor signage is fading or ultraviolet damage. However, depending on your location, you may have to contend with hail, snow, lots of moisture, freeze-thaw cycles (which cause warping and cracking), and non-weather-related problems such as golf carts, graffiti, kids swinging and grabbing signs and frames and other unpredicted variables. Research your options and talk to several different product vendors and designers to get an idea for what you can do within your budget that will withstand at least some weathering and abuse. Consider not only the lifetime of a product but also its safety as it deteriorates; wood, for example, can begin to splinter and then can cause real injuries. We print temporary signs not on laminated paper (which lasts about two days) but on a self-adhesive, printable vinyl that is UV resistant (we use UV-resistant ink as well) and adheres cleanly to mounting surfaces such as Sintra, smooth wood or our interior walls. This material is in use in a variety of gardens and museums and although it fades over a few months, it is a good temporary solution for weather-resistant signage.

Although ADA standards allow for both white letters on dark backgrounds and dark letters on white backgrounds, consider the placement and duration of your signage. Outdoors in the sun where bright colors fade quickly, white lettering becomes increasingly difficult to read as the contrast with the background diminishes over time. In these conditions, black lettering on a light background lasts much longer. In an indoor environment, fading may not be an issue and the reversed type may appeal to you from a design standpoint. The contrast between type and background should be at least 70% in all cases. Avoid placing images behind the lettering; using images this way can make it difficult for people with limited sight to read.

White is problematic as a background color in the outdoors as well. In the glare of the sun, it can be too bright to look at. To mitigate the glare on our signage, we have switched to a soft green background for our interpretive signs (with black text). Not only are these signs easier on the eyes, but they

complement the gardens nicely, appearing to blend in rather than competing with the plants for attention. We use other muted colors for outdoor signage for special exhibits (light blue or beige for example).

Many options exist because the market is constantly changing and adding new products; it's best to shop around and see what's new. Options for a given budget may be quite varied. Quality comes at a price; sturdy signs with colorful, high-quality panels can cost thousands. Know your budget before you go shopping, so that the vendors can present you with realistic options and not waste time. Look for guarantees against fading, breakage and so forth. Our signage comes with a 10-year warranty against UV damage and we have used it!

Behavior Enforcement

Some behavioral signs (such as warnings to stay on the path) will always be necessary. However, where possible they should be kept to a minimum in favor of subliminal cues such as strategic berms, prickly plantings, visual and physical borders or occasional inconspicuous ropes or chains. A few strategically placed interpretive panels might explain the uniqueness of the garden's specimens and the importance of preserving rare and special plants or describe why a botanic garden is a "living museum". Such messages will foster a sense of reverence and stewardship toward the gardens and provide positive cues to visitors to take appropriate care as they walk through the site.

Such subtly integrated visual cues will also minimize the "clutter" that too many small signs and warnings can create. In addition to improving the aesthetic experience, the subtle, unwritten cues will increase the chances that visitors will read those signs that you do have.

Custom-Tailored Design

The design — both of the sign panel (content and graphics) and of its holder, frame and/or post — should be tailored and coordinated specifically to the site. Botanic gardens are places of beauty and most visitors are seeking an aesthetic experience. Above all else, garden signage should blend with its environment rather than clash with it and be subtle rather than obtrusive. Signage should never interfere with key views and placement should take into consideration such factors as special events and weddings, traffic flow, garden entry points and ease of reference to the garden in question.

Text and Images

Many concepts are more effectively communicated to a wider audience through graphics or charts than through a cumbersome verbal explanation. In fact, signs should not rely on large amounts of text. Signs should be designed to communicate their key messages quickly and easily by combining visually appealing graphics and images with short text segments and logical organization. This type of design also ensures that many more visitors will take home the important elements of your interpretive goals, thus increasing your educational impact.

Ideally, a passing visitor who does not stop to actually read the sign will still get an idea of its content just by glancing at it. We use graphics, photographs and colors to communicate each garden's essential moods and messages that even a nonreader, or a non-English reader, will be able to relate to. For example, a sign for PlantAsia (our Asian steppe and woodland garden) features a panda, a bamboo plant, the exotic leaves of a Japanese maple and the swirling smooth stones of our hand-crafted pathway and small inset photographs of a bustling city in China and a remote windswept mountaintop in Pakistan. Together the images alone convey a strong sense of place and suggest the diversity and complexity of the region from which these beautiful plants hail.

Photograph - Tad Lusk

Balancing imagery and text is a key component of effective interpretive signs

Design Guidelines for Digital Interpretation

Designing a well-organized Web site is very similar to designing good signage. In the current era, more visitors will be seeking information online about your garden or organization than in person. It is imperative that your online and multimedia programs be treated as any other interpretive media and designed with the same care to content, layout and ease of viewing. All of these factors will help your visitor navigate through the information presented and actually absorb the most critical part of your message. The accompanying guidelines will help you design interactive kiosk programs, web sites and other electronic interactive displays that are visitor friendly and provide effective interpretation.

DIGITAL DESIGN

- Maintain a simple, consistent page layout throughout your site. A consistent design and look makes it easier for visitors to locate the specific information they seek. For example, a feature presented on every page, such as a standard navigation menu or logo for the site, should always appear in the same place. A clear, consistent presentation will especially assist people with visual impairments or learning disabilities who have difficulty using disorganized navigation schemes.
- Keep backgrounds simple. Make sure there is enough contrast. People with low vision or colorblindness, or those using black and white monitors, can have difficulty reading information at sites with busy backgrounds and dark colors. Some background images and colors obscure text and make reading difficult. Make sure that there is enough contrast between your text and the background of the page. Choose background, text and link colors carefully and always test your site by viewing it at different resolutions and color depths. For example, you can change your monitor settings to a resolution of 640 × 480 and 16 colors for one test and then change to 1,024 × 768 and 24-bit color for another. Remember that 10 percent of the population has red-green colorblindness to some degree, so do not use those two colors together as background and foreground or as separate lines on a graph that the visitor is supposed to distinguish.

VIDEO AND AUDIO

- Caption video and transcribe other audio. Multimedia formats that include audio can present barriers to people with hearing impairments as well as to people with less sophisticated computer systems. Provide captions and transcriptions for these resources so visitors who cannot hear have an alternative method for accessing the information.
- Provide audio description and captions or transcripts of video. If the multimedia resources provided on your site include video, people who cannot see will be unable to use this information unless it is provided in an alternative format. A text transcription provided with the video will give a visitor who cannot see access to the information in your video clip. Captions and transcripts also provide access to the content for those who cannot hear.

Sending Your Visitors Home Happy

Interpretation is a key component of your garden's operations. It is not just an add-on to the plantings and exhibits, but rather the critical link that will help your visitor understand and appreciate your collections and your efforts. Give interpretation the attention it deserves and don't mince on quality! According to surveys, interpretation and signage contribute significantly to visitor satisfaction. Pique your visitors' interest rather than trying to tell them everything and make them comfortable enough to read and absorb by keeping the word count down, colors and fonts legible and materials safe and attractive. Remember, they are visiting — and reading your interpretation — for fun, not because they have to! Engaging, attractive and provocative interpretation will make their visit even more fun and imbue it with a sense of meaning and enrichment.

Good interpretation will add value to the garden visit and ensure that your visitors not only are inspired to return again, but also feel compelled to spread the word to others to share their memorable experience. It is hard to imagine having a more positive effect on a garden or museum visitor than that!

The West's Discovery of Its Sense of Place

A Brief History Dan Johnson

Curator of Native Plants, Denver Botanic Gardens

It is really impossible to measure the cost of children growing up in artificial surroundings with no sense of the interplay of climate, soil and topography, no experience of wildlife or the natural world, no sense of where they really live.

Dan Johnson

There is an inevitable disconnect between the newcomer and the unfamiliar. The landscape of the "Great American Desert" was deemed hostile and worthless by pioneers of the early nineteenth century. The area's only potential was to be tamed, reclaimed and civilized. Appreciation of native plants; understanding of established ecosystems; the inherent value of broad, unspoiled landscapes and all their components — these were matters understood by only a handful of people during that pivotal time when prairies were turned by the plow and city streets laid out in the dust.

Early in Colorado's history, survival in a harsh land was paramount — there was little room for error. Farming here was a challenge even in good times and in the nineteenth and early twentieth centuries, settlers learned quickly that different approaches from those of the East were necessary. During this period in the Mountain West, gardening for pleasure was secondary at best, a luxury indulged primarily by the wealthy and steeped in the traditions of the East. In homage to cities like Boston and Chicago, grand tree-lined avenues bound affluent Colorado neighborhoods against the frontier rather than uniting them with the surrounding wild lands and vistas.

Even now, with only one hundred or so years of "gardening" behind us, the patterns are set. For many, it still is difficult to see beyond tradition and to embrace the look and feel of the natural western landscape. Certainly we appreciate the wild landscape — in its place, out "there" somewhere beyond our cities and towns — but it has seldom been the inspiration for our own garden designs. Little if any clamor is heard when pristine prairies or foothill meadows are dozed away in an instant to make space for another brand-X mart or "single family unit." And sadly, no landscape is more yielding than the fragile short-grass prairie. Self-sustaining natural gardens and priceless scenery are replaced with unsustainable landscapes that would perish in a matter of weeks without their life-support systems of poly pipe and valves and diverted water.

Photograph – Scott Dressel-Martin

The Laura Smith Porter Plains Garden at Denver Botanic Gardens

Much of Colorado's early settlement flourished during the relatively wet years between 1905 and 1929. To the primarily agrarian population, the 1930s brought the Dust Bowl and a rude awakening. Since then, agriculture has largely adapted to the reality that drought is standard fare throughout the West.

However, when the drought of 1976–1977 struck, a growing urban population and a burgeoning tourist and ski industry felt the impact in new ways. Economies were strained and lawns went brown. Suddenly the myth of endless and abundant water was dashed.

As so often happens, the crisis passed and by the 1980s, wetter weather had dulled the urgency felt by so many during the throes of drought. Savvy gardeners had taken notice, however.

The Challenge of a Botanic Garden

In the early days of the 1980s, Denver Botanic Gardens was already well respected for its vast collections and cutting-edge designs.

Yet even at Denver Botanic Gardens, little residual evidence existed of the water crisis of the mid-seventies. Only a few scattered plots of native plants were sprinkled through the gardens and no large gardens were dedicated to the theme of water conservation. Traditional collections of roses and peonies and annual bedding plants held a powerful grip over most of the 23 acres.

Still, an awareness was dawning and plans were under way. The Laura Smith Porter Plains Garden came to fruition in 1983. It was conceived and created by Gayle Weinstein, along with Denver Botanic Gardens' staff and volunteers, as a tribute to one of Colorado's early settlers, Laura Smith Porter. Rick Brune, as primary gardener, played a big part in its creation. Its purpose was to give city dwellers a sample of what Denver had been like a century ago: a wide open prairie where slight changes in topography, soil and exposure fostered a subtle diversity in native drought-tolerant plant communities. It was an immediate success and thanks to the forethought and early work in this effort, the essential elements of this garden still flourish with only occasional intervention.

The Laura Smith Porter Plains Garden has an untamed style that is hard for some to embrace. Occasionally, visitors can still be heard to mutter, "I wonder when they plan to do something with this area." Here, grasses and wildflowers run riot, presenting a vision quite incongruous with the concept most people still hold of what a garden "should" look like. Left largely to their own devices, plants move about the garden, seeding into their preferred niches and crowding up against their neighbors as they might in nature, with an ebb and flow dictated by the season at hand and the whims of weather. Seasonal highlights of lemon yellow or blazing red and purple broaden the color palette, but the connotation is that of our natural landscapes. "Green," as most gardeners know it, is a fleeting experience in this garden just as it is in nature.

This innovative garden unwittingly marked the beginning of a profound shift in the tenor of regionally attuned horticulture. Out of its success an effort arose to transform the basics of gardening in the arid West to be sensitive to the demands of a High Plains climate. Gardens were compartmentalized into wetter zones and drier zones. Plantings were modified to include more drought-tolerant plants. For the first time, the everyday gardener might consider the usefulness of native plants — a realm previously limited to a few eccentric gardeners on the fringe. Soil preparation and the use of mulches and efficient irrigation were encouraged and vast sweeps of thirsty lawn were scaled back to more conservative proportions.

Through the efforts of Denver Water and the landscape and gardening industry, a new word was buzzing about. "Xeriscape" was born of the indisputable need to adjust our gardening style and habits to the reality of where we live. (Xeriscape is a registered trademark of Denver Water.) Denver Botanic Gardens expanded its efforts to provide the first real example of what a "xeriscape" — or dry landscape — could entail. With innovative use of western native plants, the world's first Xeriscape Demonstration Garden came into being in 1986. A unique garden, based on the original "seven principles" of xeriscape design, began to take shape. From its inception, this garden had an informal style drawn more from the dominant ecosystems of the interior West than from familiar garden tradition. Dozens of unique western plants that had rarely been seen in public or private gardens before now thrived along its rock ledges and grassy glades.

New opportunities and a fresh awareness began to emerge from these efforts. Sunny, dry gardens with boulders, various aspects and well-drained soils provide an endless range of niches and microclimates, just as the same features in natural landscapes would.

With water conservation as a major goal, our focus turned toward drought-loving desert and Mediterranean plants. Through the 1980s, such novelties were often hard to locate and investment in such risky plants was attempted only by a few curious home-gardeners and botanic gardens. Now more and more nurseries and plant propagators are looking to native plants as a potential source of revenue and a way to capitalize on the burgeoning interest in drought-tolerant plants and native gardening.

The improving availability of native plants from all over the arid West and a renewed commitment to gardening with them allowed our plant trials to increase significantly. Nearly unknown in Colorado gardens, plants like New Mexico agave (*Agave parryi ssp. neomexicana*), golden prickly pear (*Opuntia aurea*) and sacahuista (*Nolina microcarpa*) thrived with no supplemental watering and added a bold sculptural element not achieved by most hardy perennials. The burnt orange and coral of sunset hyssop (*Agastache rupestris*) became a mainstay of regional landscaping. Hailing from the east slope of the Sierra Nevada, little-known Mojave sage (*Salvia pachyphylla*) with its pungent ever-silver leaves and dusky rose-purple flowers was first grown here in 1998. It sailed through the drought of 2002 without a drop of irrigation and has since been chosen as a fantastic Plant Select introduction.

Parry agave (*Agave parryi ssp. neomexicana*) in the Water-Smart Garden

As the Xeriscape Demonstration Garden has matured over the years, it has become a tribute to the durable plants and dry landscapes of the West. In fact, by 1997, the irrigation in this garden and the adjacent Laura Smith Porter Plains Garden was suspended completely except for infrequent exceptions made for new plantings. Two years later the name of the Xeriscape Demonstration Garden was changed to Dryland Mesa — a title more evocative of wild western terrain and its unique plant communities. Now, after 10 years of no irrigation, the plants have retained their compelling natural attributes and they continue to thrive and flower through all the vagaries of our changing weather.

A Smarter Garden

In the meantime, homeowners and landscape designers often saw the concept of gardening with native plants as an "all or nothing" endeavor. They planted either an exclusively native garden or a traditional garden, with rarely any overlap. Such efforts usually took the form of a shapeless "meadow" mish-mash that confused the onlooker. These native gardens, often relegated to back alleys or wasted areas that were seldom used, were frequently doomed to failure, as weeds and neglect left them no better off than any previous attempts. Even the most xeric native gardens need some care!

Unfortunately, the early images of xeriscape became tainted with what some felt were negative stereotypes. The concept seemed rooted in deprivation, having to "go without" the lush green luxuriance people so often associate with a "real garden" and settling for only a tiny oasis of green while surrounding beds of gravel and cacti simmer in near Saharan heat. It soon became clear that what was needed was the creation of a broad new garden style that focused almost entirely on plants known to have a similar and strong affinity for drier garden conditions — not just drought tolerant, but drought loving.

This new evolution in style required a smarter garden with more reasonable needs and no apologies for its lack of rhododendron or astilbe.

These plants needed to thrive in dry conditions with every bit as much vigor and seasonal color as a conventional garden, yet present the full range of characteristics of such plants: silvery foliage, succulent forms, spiked leaves and frothy, wiry textures. This garden needed to live on only occasional supplemental water (or none at all!); the broadest palette of plants would be included, drawn from nearly every continent. It needed to celebrate the look and feel of the arid West — and similar regions of the world — and find expression in the same palette of colors and textures that make the natural western landscapes so compelling. After all, newcomers were flocking to the arid West precisely because of its crisp air, its vast sun-drenched landscapes and wide open sweeps of sage, gold and tan under rainless skies. So why should people insist on changing the very nature of the place they claim to love? This garden celebrated a sense of place in a rich and welcoming way that had not been done at most botanic gardens up until then.

From the original Laura Smith Porter Plains Garden to the Xeriscape Demonstration Garden and now to the Water-Smart Garden, each progressive endeavor represented a large forward shift in awareness, practicality and experimentation. Dozens of plants thought to be too tender for our climate actually thrived in the drier conditions of our Water-Smart Garden. A cast of unknowns now rushed onto center stage. Denver Botanic Gardens' luminary Panayoti Kelaidis had brought us the hardy South African ice plants just a year or two earlier. The new garden helped convey them to millions of gardeners across the continent. Salvia from arid parts of Europe and Asia and grasses and hesperaloe from Mexico grew side by side with Mediterranean thymes and lavenders. The garden exceeded expectations. It set a new standard and drew visitors in, giving them fresh options that reached out to embrace the aesthetics of our natural landscapes while also offering a rich array of color and texture and adding the adventure of cultivating unique new plants.

Native plants still ran the show in the Laura Smith Porter Plains Garden and Dryland Mesa, but in the new Water-Smart Garden, they initially acted only as "extras." As experimentation continued, many more found a place here as well. The prevailing attitude — that with native plants, it was "all or nothing" — was being slowly laid to rest. Many western natives and their selected cultivars were thriving in other gardens and adding them to this mix unleashed a host of new combinations scarcely considered in most Colorado landscapes. Autumn sage (*Salvia greggii*) had been grown in Colorado as an annual, but hardier forms were tested and proved to thrive in our hot summers and dry winters. Parry's agave (*Agave parryi*) had lived here for at least 15 years. Now the list of agaves proven hardy in our sunny microclimates had reached a dozen or more and they bristled up through carpets of pink creeping thyme (*Thymus serpyllum* 'Pink Chintz') and the early blooms of netted iris (*Iris reticulata*). Luminous spires of scarlet bugler (*Penstemon barbatus* 'Prairie Dusk') shimmered above the explosive lavender heads of Persian onion (*Allium christophii*). Ivory banners of waxen Thompson's yucca (*Yucca thompsoniana*) flowers towered among orange and gold foxtail lilies (*Eremurus stenophyllus*) from the Himalayas. This new convergence of natives and exotics was precisely the element that had been largely absent from most garden design — the unabashed fusion of the natural Western aesthetic with the best of what horticulture has to offer.

The details of creating and caring for such a garden are somewhat simpler than those for a typical xeriscape garden. Because all the plants are known to thrive on a drier watering regimen, there is no real need to supply different irrigation zones. A fine gravel mulch tempers the heat and cold of our unpredictable weather and conserves moisture. Fine gravel is usually more suitable than organic mulches, which can trap too much moisture near the crowns of plants that prefer to be on the dry side. Only light applications of organic fertilizer are occasionally used.

It would be difficult to overstate the value of beginning any garden or restoration with as clean a slate as possible. Aggressive weeds, left to their own, will compromise the integrity of any project and jeopardize

Photograph - Scott Dressel-Martin

A path through the Water-Smart Garden

its success in the future. Though the use of chemical controls is an issue in itself, there may be situations where prudent use of select products will be acceptable or even necessary.

The weeds that choose to populate a dry garden can vary widely. A handful of annual weeds are the main offenders, namely cheatgrass (*Bromus tectorum*), groundsel (*Senecio vulgaris*) and henbit (*Lamium amplexicaule*). All will germinate, grow, flower and seed in cool damp weather from fall until spring and their lively green stands out amid the dormant silver and tan of the Water-Smart Garden. Their color alone makes them easy to find — and remove — on those mild sun-warmed days of late winter and spring when we're already itching to get out and garden. They seldom germinate later in the heat of spring and summer, so eliminating them early gets us somewhat ahead of the game. Each plant removed at this time, before seed has formed, reduces the seed bank in the soil and prevents the formation of many thousands of new seeds, greatly reducing future weed infestations. It is also a great time to take stock of how well the garden is coping with the stresses of winter and to reset any young plants that have been frost-heaved from their beds.

Selecting the best plants for a drought-loving garden is an adventure that sets one onto a surprising learning curve. Careful attention to microclimates makes it easy to meet the different needs of a wide range of plants. In our Water-Smart Garden, agaves, yuccas and cacti occupy many of the hot spots. Native shrubs such as lead plant (*Amorpha canescens*) and Apache plume (*Fallugia paradoxa*) give the backdrop structure against a foil of existing piñon pines. Upright junipers and hardy forms of Arizona cypress (*Cupressus arizonica*) add strong vertical accents. Grasses such as Mexican feather grass (*Nassella tenuissima*) and giant sacaton (*Sporobolus wrightii*) soften the scene with year-round movement and fine texture. Wild buckwheat (*Eriogonum spp.*) and sea lavender (*Limonium spp.*) create pastel drifts of lemon and violet and carefree California poppies (*Eschscholzia californica*) seed about the garden in waves of neon orange.

Our south-facing Water-Smart Garden stretches along the full length of the Boettcher Memorial Tropical Conservatory, where it bakes in the summer heat and endures wide swings in temperature all year. Its rugged water-wise troop of plants has proved itself over time. Unlike our Dryland Mesa and Laura Smith Porter Plains Garden, which thrive without any supplemental water, this garden needs an occasional deep soaking, but these plants actually perform their best when kept on a leaner diet of water and fertilizer. Too much of either and they languish and flop under their own weight. Even through the 2002 drought, the Water-Smart Garden was only watered seven times all year, receiving about an inch and a half (or less) of water each time — far less than most conventional gardens require.

Mainstreaming Our Natives

A new interest in mainstreaming native plants opened the door to creating a natural style in the heart of Denver Botanic Gardens — a look that could be immediately distinguished from that of Philadelphia or Chicago or New York. Four borders surrounded the large amphitheater where so many of Denver Botanic Gardens' events and activities take place. At the amphitheater's north edge, the Water-Smart Garden was one of these and plants from the far corners of the world were thriving alongside a new infusion of western natives.

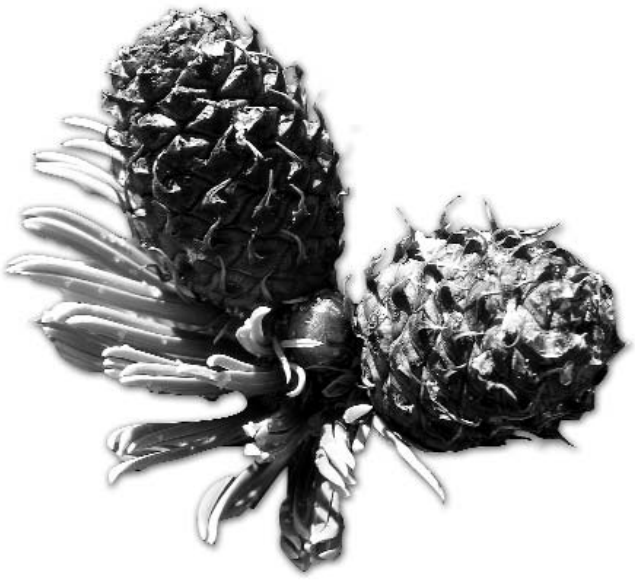
Flanking the other three sides of the amphitheater, three fresh borders were conceived, each highlighting one of Colorado's signature trees and many of the natives that would accompany them in nature, in a casual style reminiscent of their natural habitats. Yet they are not strict "revegetations," or even replications of these habitats. We had already done that in the Laura Smith Porter Plains Garden where the plants — a less select mix of natives — ran the show and moved about as they wished.

These border gardens are composed entirely of western natives and because our political borders are a contrived artifice with no reflection of native ecosystems or plant communities, we did not restrict ourselves to Colorado natives alone, but used plants from the region surrounding us as well. Meandering paths and rock outcrops lend a relaxed, natural style. Wildflowers grow, not in a wild free-for-all, but gathered into large drifts with an eye toward the techniques of more traditional garden borders. Simple layers of grass embrace swaths of color, short grasses in the foreground and tall plants in the back. A unique palette of plants makes each border distinct.

The plains cottonwood (*Populus deltoides ssp. monilifera*) was chosen to anchor the new border on the west side of the amphitheater. As the only large trees actually native to Denver, they have long been a symbol of oasis and survival on the short-grass prairie. In our Cottonwood Border they have rooted deeply and now soar above waves of blue grama grass (*Bouteloua gracilis*), desert four o'clock (*Mirabilis multiflora var. glandulosa*) and prairie winecups (*Callirhoe involucrata*). Each of these borders has its own style and its own watering needs. As riparian natives, the cottonwoods require some supplemental irrigation, so this section receives an occasional deep watering.

Ponderosa pines (*Pinus ponderosa*) grace the foothill and montane zone of most of our western mountain ranges, from rugged canyon walls to open parklands. In the east border of the amphitheater, the dappled light beneath ponderosa pines shelters Oregon grape holly (*Mahonia repens*) and the delicate blue bells of rock clematis (*Clematis columbiana var. tenuiloba*) and penstemons in red, blue and violet. The Ponderosa Border has become well established, but at Denver's elevation they seldom receive the amount of precipitation they might enjoy in nature adorning Colorado's mountains. Infrequent deep watering during the height of summer seems to serve them well.

Among the oldest living things on Earth, bristlecone pines (*Pinus aristata*) survive with tenacity on craggy wind-torn ridges. Though nowhere common, they are adaptable survivors, coping with intense sun and drought, even in lower-elevation gardens. Our south border, with bristlecone pines scattered along a rocky ridge above well-drained slopes, features the most adaptable and colorful of subalpine wildflowers. Rocky Mountain columbines (*Aquilegia caerulea*) and Idaho fescue (*Festuca idahoensis*) cover open meadows and harebells (*Campanula rotundifolia*) nestle in rock crevices. In their natural habitat, these plants would receive more precipitation than either ponderosas or cottonwoods. Moisture runs deep alongside the boulders and careful planting helps to shade and cool the soil, so the Bristlecone Border requires only slightly more irrigation than the Ponderosa Border. Though not irrigation-free, all these borders demand far less water than most conventional borders.



Among the oldest living things on earth, the well-named bristlecone pine (*Pinus aristata*) is a tenacious survivor, able to cope with intense sun and drought

In Denver and its surrounding communities, well-watered landscapes, golf courses and suburbs plod up and down along the edge of the desert steppe. The plants are bathed year round in intense sunlight; they are catapulted from one season to the next in a matter of hours by wild swings in temperature and ferocious winds. Annual rainfall typically averages about 15 inches, but some years have as much as 24 inches or as little as seven.

Colorado's predominantly dry steppe climate has more in common with the desert and Mediterranean-type climates to our south and west than with the soggy climates of the East and Northwest. Still, few of us have looked to this reality when searching for garden inspiration. Most want to emulate the leafy, moss-draped maritime climates of the East and West Coasts or look still farther to Britain or Japan. For style and design, much may be gained from the accumulated millennia of gardening experience in these regions, but our own backyard can supply something they cannot.

The vast and primal topography of our deserts and grasslands has a powerful simplicity of style and a complexity of composition. Left to itself, our natural landscape presents a palette of sage and rust, tan, green and gold under a yawning dome of blue sky. Although the grand landscapes can draw us in, it is this richness of detail that can bind us more seamlessly to our surroundings. With a tangible sense of place, our homes and gardens and parkways need not jar so with the gentle curve of prairie or the fragrant sweep of ponderosa parkland. One needn't abandon horticulture to be responsible and attuned to landscape and climate. There is an untapped wealth yet to savor in the garden.

WHY USE NATIVE PLANTS

- Conservation of limited resources
- Preservation or restoration of plant diversity and natural habitats for wildlife in biologically balanced natural areas
- Creating and preserving a "sense of place" in communities
- Developing a more exciting palette of plants for landscape use

A Future for Natives

One cannot discuss the future of our landscapes, natural and otherwise, without a certain amount of philosophy entering the conversation. *It is really impossible to measure the cost of children growing up in artificial surroundings with no sense of the interplay of climate, soil and topography, no experience of wildlife or the natural world, no sense of where they really live.* With that said, it is easy to cite several basic and compelling issues that support the increasing use of native plants in the landscape.

Water savings is the most obvious benefit realized through the use of more native plants. Many species that grow in the lower elevations and rain shadows in the West are adapted to thrive on low amounts of natural rainfall. Creating landscapes with these plants instantly reduces the irrigation needs. Additional savings as a result could include not having to install and maintain complicated irrigation systems and the manufacture — from petroleum and mined resources — of miles of poly pipe, valves and wiring. Consider the impacts of drilling, mining and manufacturing these raw materials. Consider the amount of fuel needed to mow a lushly watered lawn and the impact of fertilizers and pesticides on watersheds and wildlife.

A landscape designed with "natural" areas or incorporating significant numbers of native plants, especially if acquired from local sources, acts as a reservoir for genetic material that is well adapted to local conditions. Properly designed landscapes can mitigate erosion problems and help sustain aquifers. Landscapes with natural areas provide critical habitat for countless insects, birds and other fauna that are typically eliminated from urban and developing areas. Such landscapes can thrive on natural precipitation and can survive periods of drought or extreme weather without costly intervention.

Ornamental gardens and landscapes that are designed with native plants (even if not exclusively native) retain many attributes of our natural surroundings. The focus on texture and seasonal shifts from green to gold and tan links us visually with our native prairies, mountains and deserts. This effect is commonly referred to as a "sense of place," and it creates an interface between urban and natural areas that is more seamless. (Consider the jarring appearance of a fluorescent green golf course in the desert!) Such an interface creates communities that seem to be part of their natural surroundings rather than at odds with the natural world.

The choice of available native plants has steadily increased in recent years. A slower part of this process is the work of finding the best of our natives for the average gardener to use. Though many native plant selections have been made over the years, this resource is relatively untapped. The work of collecting specimens or seed and growing them in trials to assess their suitability for cultivation is time consuming. Beyond that, the next step of selecting the very best plants, or those plants with exceptional characteristics, can require years of trial and research. To then move these selections into production so that the public can benefit requires organization and more time and resources still.

In a world where quick profits are usually the bottom line, an added measure of dedication to a higher cause is required. This is part of the work of Denver Botanic Gardens, Colorado State University and the green industry through its Plant Select program. It is hoped that many more native plant selections will find their way through this program to the gardening and landscaping public. This is one way we can encourage better stewardship of resources to enhance our sense of place and be more environmentally aware in our interaction with gardening and the natural world.

Mount Goliath

Footpath to the Sky

Panayoti Kelaidis

Senior Curator and Director of Outreach, Denver Botanic Gardens

The M. Walter Pesman Trail on Mount Goliath drops nearly 1,000 vertical feet to the Dos Chappell Nature Center

The Denver metropolitan area is defined by the dramatic mountain backdrop. As surely as New York City or Venice is defined by water, the stark spine of the Continental Divide provides a mercurial and constant backdrop to the lives of nearly four million people who occupy the ecotone between the Great Plains and the Front Range of the Rocky Mountains. All winter long on weekends, the mountain highways are crowded with skiers headed westward and then eastward home again. In the growing season the same highways are often gridlocked with mountain hikers, campers and worshipers fleeing the hot and crowded city.

Over a hundred peaks are visible on a clear day from much of metro Denver. To the north one can discern the Mummy Range, nearly a hundred miles away near the border of Wyoming. From the Mummy Range southward along the skyline, the jagged horizon of the Front Range rarely drops below 12,000 feet all the way to Pikes Peak — one of America's most famous mountains — some 70 miles south of Denver. Pikes Peak is the southernmost of the five mountains that rise to over 14,000 feet that are visible from metro Denver. There are 49 "fourteeners" that can't be seen from the metro area, a good indication of how much rugged country extends for hundreds of miles beyond and across the rest of the state.

The northernmost fourteener of the Front Range is Longs Peak, the lofty "knees" of the Sleeping Indian that stands out so clearly some 60 miles northwest of Denver. Grays and Torreys Peaks are

in fact the highest mountains of the Front Range. However, these are only visible from certain vantage points around the Denver area, because they stand due west of Mount Evans, Denver's nearest fourteener. Mount Evans is the mountain that symbolizes, exemplifies and perhaps defines the character of Denver more than any other mountain in the great Rocky Mountain Chain.

Mount Evans and the Botanical Peaks

Mount Evans is named for the second territorial governor of Colorado, John Evans, who served from 1862 to 1865. It is 4,350 meters in elevation (14,264 feet), nearly 50 meters higher than Pikes Peak. Unlike Pikes Peak, which looms over the city of Colorado Springs, Mount Evans is perched a dozen or so miles farther west from Denver. As a consequence, it does not dominate the skyline so much as provide a benign, albeit majestic, presence that I suspect many native metro residents could not even name. Mount Evans itself is partly to blame for this because it isn't just a single mountain, but rather a massif, or cluster of peaks including Mount Warren and Roger Peak as well as Mount Goliath, the northernmost point on the crenulated wall of the Mount Evans massif that is nearly 15 miles wide above treeline. Colorado Highway 5, which climbs nearly to the summit of Mount Evans, emerges above treeline near the Dos Chappell Nature Center on the lower slopes of Mount Goliath. The highway then loops around the entire north slope of the mountain, to near the summit of Mount Goliath where the M. Walter Pesman Trail begins, before winding scenically another 10 miles to near the summit of Mount Evans proper where the highway terminates. The Pesman Trail, over 1 mile long and dropping nearly 1,000 vertical feet, terminates at the Dos Chappell Nature Center and the constructed rock garden surrounding it, which constitutes the Mount Goliath unit of Denver Botanic Gardens. The trail is named for Walter Pesman, one of the leading landscape architects of Colorado, who wrote the popular wildflower guide "Meet the Natives" and was a champion in the creation of Denver Botanic Gardens. Over the past half century, the site has been developed and managed cooperatively with the Forest Service, with tremendous support from the Volunteers for Outdoor Colorado and the Garden Club of America.

I suspect most residents of the Front Range have driven to the summit of Mount Evans at least once in their lives and many visitors make a beeline to this pristine and majestic mountain. Few are aware that the central and highest part of the Colorado Front Range beyond Mount Evans is often called the "Botanical Peaks" just as the section north of James Peak is called the Indian Peaks and the ranges to the south are called the Tarryall and Rampart Ranges. The Botanical Peaks commemorate many of the leading American botanists of the nineteenth century, starting with James Peak at the north. Edwin James was the botanist accompanying the 1820 Long Expedition, the second official American Government exploration party to come to Colorado. James collected the first botanical specimens in Colorado and was the first scientist to climb above treeline in the entire West. Edwin James was a student of John Torrey, who published James' collections from the expedition. These included bristlecone pine (*Pinus aristata*) and the Colorado columbine (*Aquilegia caerulea*). In addition to James and Torrey, Asa Gray and George Engelmann are the best-known botanists commemorated in this stretch of the Front Range.

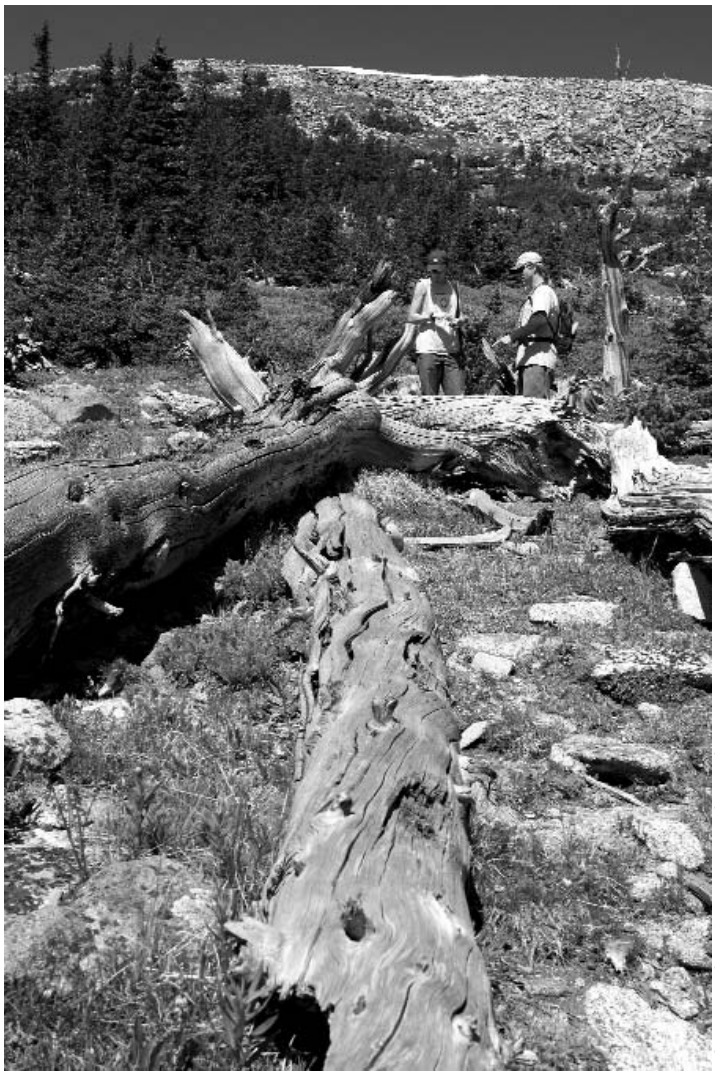
Other Botanical Peaks are Mount Parry and Mount Flora. Charles Christopher Parry was a medical doctor and botanist who lived in Davenport, Iowa and spent summers in his cabin in Grizzly Gulch, at the base of Grays Peak during the 1860s and 1870s. Parry's extensive plant collecting so early in the state's history resulted in the discovery of dozens of species new to science, many of which were named for the collector. Parry's clover (*Trifolium parryi*) and Parry's primrose (*Primula parryi*) are two of the most conspicuous and widespread Southern Rocky Mountain endemic species that commemorate this influential Iowa doctor who was also a popular newspaper columnist. Both of these are found abundantly on Mount Evans. Botany and botanical exploration were subjects of such widespread interest in the nineteenth century that Parry's newspaper columns were syndicated across America. His influence was such that his names for the loftiest peaks thus far known for the state prevailed over the dozens of other popular nicknames that miners had come up with for the various peaks in the Front Range. Being the two best-known American botanists of the nineteenth century, Asa Gray and John Torrey naturally merited the highest peaks and Parry thought these were the highest in all the Southern Rockies. He would be disappointed to learn that Mount Elbert, in the Sawatch Range, has been determined to be the highest peak in Colorado at 14,433 feet.

The accessibility of Mount Evans is such that few other mountains in North America have been so thoroughly and frequently explored and studied. Over the decades a number of Denver Botanic Gardens' staff and volunteers — including Dr. Janet Wingate, Dr. Carol Dawson and Loraine Yeatts — have systematically collected specimens on the mountain that are deposited at the Kathryn Kalmbach Herbarium. A number of striking plants are found only on

Pikes Peak, including Hall's coral bell (*Heuchera hallii*). Thus far, no plant on Mount Evans has proved to be strictly endemic to the mountain, although many plants first found on Mount Evans have subsequently been found elsewhere in the state, notably *Botrychium echo*, a tiny moonwort named for Echo Lake at the start of the Mount Evans highway. This species is now known from a number of localities around Colorado and even Utah.

The east-facing cirque at 13,000 feet surrounding Summit Lake is designated a Research Natural Area and has special significance for alpine botany in the Rocky Mountain region. The size, aspect and situation of this cirque is such that in some years, Summit Lake is only free from ice for a few months. As a consequence of the prolonged cold and the sloping terrain around the lake, a wide spectrum of alpine tundra communities are richly developed on the mountain. Numerous alpine plants that are better known from much farther north, even in arctic regions, were first found in the Southern Rockies on Mount Evans, such as ice grass (*Phippsia algida*) and golden saxifrage (*Chrysoplenium tetrandrum*) as well as the best-known community of the only alpine annual, *Koenigia islandica*, found in the Colorado alpine tundra. One of the most striking features of Summit Lake is the wide, boggy meadows that cover the gently sloping tundra below the lake. These are filled with a wealth of moisture-loving alpines.

For many decades, the cirque was essentially the only known Colorado locality for the bog saxifrage (*Saxifraga hirculus*). This strikingly beautiful, gold-flowered miniature, which abounds in Alaska and northern Europe, forms a dense mound of lanceolate, glossy leaves and many dozens of cup-shaped flowers on three-inch stems. The flowers emerge in July and can still be found blooming in September. This beautiful alpine species grows so abundantly at Summit Lake — there can be thousands of flowers open at the same time — that it actually tints the boggy meadows yellow in late summer. As similar habitats are explored on other peaks in the state, small colonies of this rare beauty have been subsequently discovered in several other counties. None of these, however, can begin to compare with the vast golden fields below Summit Lake.



Photograph – Scott Dressel-Martin

Participants in the Applied Plant Conservation Training Program visit Mount Goliath, home to many species of Colorado's uniquely hardy flora

Alpine Plants on Mount Goliath

Bright Purple Wallflower

As one would expect on a mountain of such large scale, dozens of unusual alpines are easily found on Mount Evans. These are the same plants that are only accessed on other peaks in the state with great effort. Even Mount Goliath harbors a number of rarities. One of the showiest of these is the bright purple wallflower, a local race of *Erysimum capitatum*. In addition to its distinct coloration, it is so much more compact than the widespread flower of the lower foothills that botanists had classed the purple alpine phase as *Erysimum amoenum*. Detailed analysis, however, revealed that these two distinctive plants are essentially identical genetically. For the wildflower lover, the bright purple miniature on Mount Evans looks nothing like the willowy yellow or orange giant that one finds lower down. Elsewhere on the Front Range and indeed in most of Colorado, the alpine wallflower is invariably a vivid yellow as well. The purple phase does occur sporadically in the Collegiate Peaks and is the predominant race in the San Juan Mountains of southwestern Colorado.

Bright Yellow Buckwheat

In midsummer, a compact, bright yellow buckwheat is common along the M. Walter Pesman Trail. This little plant has been given a host of botanical names and currently resides under *Eriogonum arcuatum var. xanthum*. The flowers are almost stemless and the spatulate leaves form dense tufts, typical of alpine flowers. As they age, the flowers take on beautiful orange and bronze tints. This Colorado endemic alpine buckwheat is closely related to a much larger subspecies found at lower elevations and to a widespread lowland buckwheat found in the deserts and steppes of Wyoming and Idaho. I have not seen this buckwheat anywhere else in the Colorado Front Range. It is largely restricted to the Sawatch and Mosquito ranges, some distance to the south and west.

Alpine Rock-Jasmine

One of the choicest and most beautiful Colorado alpine plant is quite common along the M. Walter Pesman Trail: the alpine rock-jasmine, *Androsace chamaedaphne ssp. carinata*, will often come into bloom early in June with an umbel of glowing ivory, five-petaled flowers on very short stems. The eye of this and most rock jasmines is yellow when the flower is fresh, turning rose red once pollinated. The speckled clusters of flowers, some yellow eyed, some red, make an enchanting picture. The rosettes produce tiny strawberry-like runners and this habit can form quite massive specimens one foot across or so when ideally situated. The fragrance of this tiny flower, as the common name suggests, is very sweet and heady up close. It is strong enough that you can often smell it wafting in the wind. The species *A. chamaedaphne* is widespread in nature; it is found abundantly in Alaska and Eurasia, especially in the European Alps. In Colorado, I have found only our local subspecies here on Mount Evans, on Pikes Peak and in the Sangre de Cristo Mountains where it is abundant. The other androsaces in Colorado are annuals of the Andraspid section. This perennial species is closely allied to the dozens of dazzling alpine androsaces of the Himalayas that are among the most beautiful and glorious high alpines of the world.

Bright Purple Aster

There is one perplexing plant that one can find quite commonly along the M. Walter Pesman Trail from mid July to autumn: a bright purple aster on short stems two to four inches tall, rising from lax, coarsely toothed rosettes. It keys out to *Machaeranthera bigelovii*, a widespread lowland aster that is invariably biennial and can grow nearly four feet tall. I have only seen this tiny, perennial alpine race on Mount Goliath and on Grays Peak. It has been distinguished as *Machaeranthera pattersonii* and although it certainly does bear resemblance to the widespread lowlander, I think it should merit taxonomic recognition because of its perennial habit and miniature size — and distinct ecological adaptation to tundra. If so, it may be the rarest taxon on the mountain. To me, it constitutes a sort of floral emblem of Mount Goliath, a tangible symbol of how special this amazing trail is.

Subalpine Beardtongue

Another unique gem of the mountain is a pale yellow phase of *Penstemon whippleanus*. This beautiful subalpine beardtongue is widespread at higher elevations throughout the southwest. It may have the most variable flower color of any wild penstemon; it never seems to be the same on any two peaks. Strange liver-purple shades are common elsewhere in the Front Range, as well as a near-albino phase. Farther south this beardtongue can be a brilliant wine-purple color or even a true blue. On Mount Goliath, the near-albino forms predominate and many approach a lemonade yellow color extremely unusual in the genus. Generally, Whipple's penstemon occurs in clearings of spruce fir woodland above 10,000 feet but climbs to nearly 12,000 feet on the exposed tundra of Mount Goliath.

"Alpine Garden" Loop Trail Plants

Although Mount Goliath barely reaches 12,000 feet in elevation, most of the hundreds of characteristic Southern Rocky Mountain alpine plants can be found here or there on this sizeable peak. The exposed ridge traversed by the "Alpine Garden" loop trail off of the M. Walter Pesman Trail contains many high-alpine gems such as fairy primrose (*Primula angustifolia*), big root spring beauty (*Claytonia megarhiza*) and even alpine forget-me-not (*Eritrichium aretioides*), all plants that are usually most abundant another thousand feet higher in elevation. Mount Goliath is not quite large enough to give rise to permanent streams; as a consequence there are no boggy or streamside plant communities on this mountain. For them, you must proceed on to Summit Lake. The actual slope traversed by the Pesman Trail is south facing and usually comes into full bloom several weeks earlier than most of Mount Evans' tundra. Technically, the south-and-east facing slopes of Mount Goliath are not alpine tundra, but modified steppe vegetation, dominated by dozens of species of graminoids, not only grasses, but also sedges and rushes. A host of alpine herbaceous perennials is found among the grasses, as well as an impressive stand of shrubby cinquefoil (*Potentilla fruticosa*) that grows far more compactly here than it does in its more common subalpine streamside habitats. The cinquefoil on Mount Goliath forms rugged, bonsai-like drifts of krummholz. I suspect one day we will find that this alpine race is genetically distinct from the much larger lowland race. Throughout much of July and

August, this wonderful dwarf shrub speckles the rocky slopes with vivid yellow color.

The rocky outcrops have many chasmophytic plants, including the chartreuse alumroot of the foothills, *Heuchera bracteata*, ordinarily a plant of much lower elevations. The alpine display is thickest on the upper half of the trail, but many choice wildflowers persist, even in the depths of the bristlecone pine forest, which is the chief glory of Mount Goliath.

Southern Rocky Mountain Bristlecone Pine

The Southern Rocky Mountain bristlecone (*Pinus aristata*) is found throughout the southern half of Colorado and northern New Mexico. It occurs much more sparsely to the west in Arizona and Utah, where it is mainly displaced by *Pinus longaeva*, a similar but generally smaller species that is thought to be the oldest living plant on earth. It's hard to believe that these two distinct and distinctive plants were only distinguished in the 1970s when Dana Bailey, an amateur phenologist who lived in Boulder, Colorado, described *Pinus longaeva*. Superficially, both form rugged, picturesque specimens at lofty elevations in the West, but the Colorado bristlecone is generally larger and greener and grows on granitic substrates as well as limestone. *Pinus longaeva* is generally smaller, grows on dolomitic limestone and lacks the characteristic resin ducts ("dandruff") that makes our local form instantly recognizable. There are many other morphological differences between the two species, although their distribution and ecological preferences are obvious differences.

Mount Goliath is currently thought to host the second largest grove of bristlecone pines found at treeline in the state and this grove is the most readily accessible of this remarkable and beautiful tree. Although many of the older specimens look every bit as gnarly and windswept as the more westerly species, they are considerably younger; most of the Methuselahs here are only 1,000 years old, but a few have been determined to be 1,500 years old. The extraordinarily harsh, dry conditions in the Great Basin are apparently the reason why *Pinus longaeva* can live to be over 4,000 years old. The wetter, milder conditions of the Southern Rockies apparently speed up the metabolism and shorten the life span of the bristlecone pines in the Rocky Mountains.

A thousand years is certainly a respectable life span and the sheer sculptural drama of this vast grove of millennial giants invariably transfixes the attention of hikers. I find myself as fascinated by the frequent, windblasted snags in the forest: when I see ancient driftwood remains of long dead trees, I wonder how long this ancient sculpture has been dead. A century? Wood decays so slowly on these sunny slopes, at this altitude, that many of the ancient hulks could have been standing for hundreds of years. Some visitors compare this forest to the enchanted forests in fairy tales. Thousands of visitors have traversed this trail over the decades and for many it is their first experience with alpine tundra and the magic of the mountains.

The Impact and Future of Mount Goliath

Since the turn of the millennium, volunteers from Denver Botanic Gardens have led tours down the M. Walter Pesman Trail on Tuesdays and Saturdays in the summer months. The trailhead is not obvious for first-time visitors and having a

Once a bristlecone on Mount Goliath, which is thought to have the second largest grove of bristlecone pines (*Pinus aristata*) found at treeline in Colorado

docent to explain trail etiquette and help elucidate salient facts about the local mountains and the flora enhances the visitors' experience immeasurably. Many people have told me over the years that their experience being led down the Pesman Trail was the spark that inspired them to take up mountain hiking as a pastime as well as nature study. I know that since 1977 or so, I have walked the Pesman Trail several times every year, even in winter on snowshoes. I have never tired of the spectacular vistas and the constantly changing vignettes along this majestic trail. Each time I walk the trail, I seem to see something new, something I've missed before.
In the late 1990s, Denver Botanic Gardens renewed the long-term commitment to Mount Goliath by joining in a consortium with the Garden Club of America, Volunteers for Outdoor Colorado as well the United States Forest Service to redirect parts of the M. Walter Pesman Trail that had become braided and were beginning to cause excessive damage and erosion. An ambitious crevice garden was built on part of what was once an oversized parking lot by Zdenek Zvolanek and Joyce Carruthers — two eminent rock garden designers from the Czech Republic and Wales.

A few years later the Dos Chappell Nature Center was constructed. It is filled with interpretive panels developed by staff and volunteers from Denver Botanic Gardens. The original crevice garden was amplified around the Nature Center with an ambitious rock garden designed and built under the direction of Mark Fusco, senior horticulturist of Denver Botanic Gardens. Mark created a series of distinct environments to showcase the range of ecosystems on Mount Evans; he has had thousands of plants propagated from seed obtained at the site. These are arranged in artful combinations to educate visitors on the wealth of wildflowers one can find on the mountain and their ecological associations.

Although many botanic gardens in Europe boast alpine units, few have these at the terminus of such a spectacular trail and no other garden can boast of a vast grove of ancient trees as sculpturally perfect as the massive, ancient bonsai *Pinus aristata* on Mount Goliath.

Every great city seems to have a symbol: the Eiffel Tower for Paris, for instance, or the Statue of Liberty for New York City. I like to think that Mount Evans is Denver's symbolic totem. This mountain, barely an hour's drive from downtown Denver, offers panoramic views of the entire Front Range and dwarfs the pyramids of Giza with its massiveness and majesty. Mount Evans exemplifies the enormous commitment that Coloradans have to nature: the mountain teems with wildlife and the vast fields of wildflowers are free of invasive weeds, lush and carefully monitored to keep them from being trampled or damaged. On a cool summer day, with a gentle breeze surrounded by masses of colorful alpine cushion plants, with gnarled and windswept bristlecone pines for company, one somehow feels that there is hope for humanity and the planet.

Mount Goliath draws many visitors every year, including staff and volunteers from Denver Botanic Gardens

Adopting the International Agenda

Case Study of Betty Ford Alpine Gardens

Nicola Ripley
Director of Horticulture, Betty Ford Alpine Gardens

Photograph – Betty Ford Alpine Gardens

On the north end of Betty Ford Alpine Gardens are the Alpine Pools, reminiscent of the crystal clear ponds and lakes found in alpine areas around the world

This case study describes how a small botanic garden used the International Agenda for Plant Conservation developed by Botanic Gardens Conservation International as a tool to developing a plant-conservation program.

It is amazing what a small organization can accomplish when it is passionate and focused. This case study is about Betty Ford Alpine Gardens. Situated in the Colorado Rockies at an elevation of 8,200 feet, this small botanic garden has made great strides in conservation programs. With only a permanent garden staff of four (not including gift shop staff) and two seasonal interns, it is remarkable and encouraging what can be achieved.

Betty Ford Alpine Gardens is located in Eagle County in the ski resort town of Vail, approximately two hours west of Denver, high in the Rocky Mountains. A remarkable plant collection of about 3,000 alpine and mountain perennial species has been established on three acres over the past 20 years. Typical of most small botanic gardens, the organization is a nonprofit (501c3) run on a modest annual operating budget with a dedicated group of volunteers and donors.

It was clear to the organization early on that with a small budget and small acreage, priorities for what was important would have to be established. At an elevation of 8,200 feet, a collection of plants impossible in other parts of the country could be developed. Such a garden would offer a unique sense of place and would display high-alpine plants that many people may not be able to see otherwise. After making the commitment to growing alpine and other mountain plants, the next move was to

take the collection a step further and make a commitment to public education about mountain plants and to their conservation. Thus education became a very important part of Betty Ford Alpine Gardens' mission.

Adopting the International Agenda

To first step toward adopting the agenda was to make the case for conservation to the board of directors. Each director was provided with a copy of the agenda and an executive summary. Once the full board was in agreement and signed off on the international agenda, Betty Ford Alpine Gardens began using it as a tool to develop a conservation plan.

The International Agenda for Botanical Gardens in Conservation, released by Botanic Gardens Conservation International in 2000, is an extremely useful tool for helping gardens develop a conservation plan and guide conservation activities. Launched as a collaborative effort for botanic gardens worldwide, the agenda presents a goal of each garden's playing a local role that, when combined with other efforts, makes a global impact. Being part of a larger commitment, in this case a worldwide commitment, made it easier to feel that even a small contribution to this global initiative was worthwhile.

INTERNATIONAL AGENDA'S INITIAL PRIORITIES

- Undertake a review of the mission and the capacity of the individual institution
- Assess current activities and priorities and check the status of these against key tasks outlined in the agenda
- Develop a plan for the implementation of the agenda
- Develop partnerships

The gardens have a comprehensive but succinct mission statement: "To inspire a passion for plants in high altitude communities through beautification, conservation, education and research programs." This mission embraces conservation and research and provides the framework on which a conservation plan can be built. The biggest and continuing challenge for a small garden is, of course, budgeting for staff to carry out conservation activities, so it was apparent from the beginning that until the annual operating budget increased to allow for another staff person, some sacrifices to the plan would have to be made. However, having education, conservation and research such key parts of the mission makes it easier to prioritize funding.

The international agenda lists all the key tasks that are considered "the practice of conservation." Everything from actual conservation work to educating the public and documenting the collections plays a role. A program for conservation covers each known threatened plant and ecosystem in the botanic garden's region. The capacity of the botanic garden is developed for biodiversity conservation. Current information on the activities, collections and facilities is provided to other botanic gardens to support biodiversity conservation. Public education programs on conservation, sustainability and the environment are created and/or strengthened.

Comparing programs at the Betty Ford Alpine Gardens with the key tasks targeted by the agenda allowed us to identify where we were succeeding and where we needed to focus any new efforts. What soon became clear to the board and staff was that many of the activities already undertaken at the gardens, when considered as part of an overall plan, were already contributing to conservation goals.

Our Review of Existing Programs

Plant Monitoring and Conservation

The Betty Ford Alpine Gardens is currently working for the Bureau of Land Management on year five of a six-year monitoring program for two of Colorado's most threatened plants, Parachute beardtongue (*Penstemon debilis*) and Debeque milkvetch (*Astragalus debequaeus*). These two plants are native to Garfield County in western Colorado and grow on oil shale formations that are threatened by mineral exploitation. Permanent transects have been established, along which the occurrences of the two plants are recorded each year. From these results a conservation strategy for these two plants will be developed.

In addition, the Betty Ford Alpine Gardens is the Eagle County host for the "Adopt a Rare Plant Program" developed by the Colorado Natural Heritage Program. The county program involves both conservation and education and is implemented by staff and volunteers. At an annual training provided by gardens staff, volunteers are introduced to the rare plants of Eagle County. Plants are described along with pictures, herbarium specimens and habitat photographs. Each volunteer is then encouraged to "adopt" one of the rare plants. Known locations for the plants or element

Photograph - Betty Ford Alpine Gardens

Habitat of *Astragalus debequaeus*

occurrences are then shared with each volunteer. It becomes their job to check on the known occurrences and record the status. For instance, some reports have shown new bike trails running through or close to key populations. Once familiar with the plant and its habitat, the volunteer is asked to search for the plant in similar habitats in the hope of finding new populations. Each time an old location is verified or a new location identified, the volunteer fills out a sheet of detailed information that is sent to the gardens with a copy forwarded to the Natural Heritage Program for their records. Once compiled, this data from all over the state provide the Natural Heritage Program with information about the status of rare plants from which to set a priority for conservation.

Plant salvage operations have been successful in protecting plants that would otherwise have been destroyed. During salvage the gardens staff go to a site scheduled for construction or demolition and remove valuable plants, which are then transferred to other sites or to the gardens themselves. Although this is always a last resort, it provides an opportunity to learn more about the growing requirements of some rare and unusual native plants. The Betty Ford Alpine Gardens now has valuable information available about the expected success rate when transplanting some of the local rare flora.

Education

Information is dispensed at the gardens in a number of different ways, from workshops and lectures to permanent interpretive exhibits. For adults, laminated "notebook pages" describe a variety of topics such as adaptations to alpine environments, rare plants, wetlands, botanical research and high-altitude gardening. In the Children's Garden the theme is a miniature hike up the local mountain range. Children "hike" from Vail in the "montane" life zone up through the "subalpine" and into the "alpine" life zone. The area along the "hiking path" displays native plants characteristic of the respective zone. Interpretive displays tell the children about the plants and animals of each ecosystem with some simple question and answer panels. Animal tracks stamped into the concrete across the path at various points lead children to a picture of the animal that made the tracks. On the way back down the mountain, stepping stones through a wetland lead the children to a beaver display that explains the animal's role in the ecosystem. They also learn about mountain climate and its impacts, for instance, mountains as catchments for important moisture that feeds rivers and the effects of sun and shade on the environment. Interpretation in the "alpine" zone emphasizes the fragility of the alpine environment and how we must respect it and protect it.

In the Children's Garden, interpretive signs lead visitors through different life zones on a simulated hike to the summit of the Gore Range

Sharing the Data

The Betty Ford Alpine Gardens uses a database called BGBase™ for all its plant-collection records. This database provides a scientific record of all the plants that have ever been grown in the gardens. It is widely used by other botanic gardens, which allows for easy data exchange. The vast capacity of the database means that extensive information can be gathered on each plant in the garden. This capability is extremely important for wild-collected accessions that may one day become an important part of a reintroduction program. The information from this database is available to the public online, both at the gardens' own Web site and at a collaborative Web site operated by BGBase™ that lists all users of the program who have data available on the Internet. In addition, this information is shared with Botanic Gardens Conservation International (BGCI) as part of a global collection of plant data. Through this sharing of information, quick assessments can be made on the number of rare plants that are part of the collections at a particular botanic garden. This process meets one of the goals of the Global Strategy for Plant Conservation, published in association with BGCI. If reintroduction plans are necessary, the information is available as to where suitable replacement plants may be located. This process also can be used to prioritize conservation programs. It is important and useful to know which rare plants are already protected in *ex situ* collections as well as which plants are part of an active conservation program at a botanical garden. Although there may be arguments for and against the use of *ex situ* plants in reintroduction programs, it is normally agreed that having an *ex situ* collection is better than having no collection at all.

Partnering in Other Local Efforts

Finally, the Betty Ford Alpine Gardens is involved in programs beyond those that are strictly its own. A Junior Ranger program in the local community connects young children with the gardens and with other local organizations that are involved in environmental activities. The gardens are a member of the Colorado Plant Conservation Alliance, based at Denver Botanic Gardens. This group connects all the Colorado organizations that are involved in plant conservation so that they can share resources and information to avoid duplication of efforts and identify gaps. The Colorado Rare Plant Technical Committee meets once or twice a year to bring together mainly federal agencies working on conservation programs to compare notes and prioritize efforts.

Success and Future Directions

In comparing the list of activities at Betty Ford Alpine Gardens with key tasks in the international agenda, we found we have indeed adopted the international agenda. The gardens are working toward a conservation program for two of Colorado's rare plants. By making conservation, research and education important parts of the gardens mission, the institution's priority and capacity for biodiversity conservation is being developed. The gardens have submitted information on its plant collections to a worldwide database. Finally, Betty Ford Alpine Gardens is now focusing its attention on the amount of education resources devoted to conservation.

Once compiled and assessed, this exercise provided a useful framework from which to implement the agenda. It became clear that while the gardens are making strides locally toward meeting the targets of the agenda, there are still many areas that can be developed as part of short and long term goals. For example, the gardens could take the plant-monitoring programs a step further and adopt *Penstemon debilis* and *Astragalus debequaeus* as part of the Center for Plant Conservation's program. In doing so, the gardens would develop a strategy for the conservation of these two plants and then be responsible for implementing the effort with both *in situ* and *ex situ* conservation, depending on the individual plan. Plants that are currently monitored under the Adopt A Rare Plant Program could also be formally adopted into an official conservation plan. In the near term, the gardens are investigating the possibility of fencing off a population of rare orchids that are threatened by trampling from local fishermen. In education terms the gardens can clearly do more in its permanent interpretive displays. The Betty Ford Alpine Gardens welcomes an estimated 100,000 visitors during the summers. With Vail as its setting these gardens offer an opportunity to educate large numbers of visitors with a focused message on conservation, through self-guided trails as well as an option to use the cell phone guided system. This setting gives the gardens an opportunity to educate large numbers of visitors with a more focused message on conservation, through self-guided trails or a cell phone guided system.

The final step in the international agenda is to address the formation of partnerships. Although the gardens have many partners, there is always room for more. Of particular importance is developing a plan that encourages funding partners to support the hiring of additional staff who would be devoted entirely to plant conservation and research. This aspiration is ongoing.

The concluding message is an old one, "think globally and act locally." Using a tool such as the international agenda to focus attention on existing and future programs can make the best use of restricted resources.

The Conservation Garden

A Case Study from the North Carolina Botanical Garden

Johnny Randall, Ph.D.

Assistant Director for Natural Areas and Conservation Programs, North Carolina Botanical Garden

Photograph – North Carolina Botanical Garden

North Carolina Botanical Garden staff reintroducing the federally endangered *Ptilimnium nodosum* (harperella) along the Deep River in the North Carolina Piedmont

Botanical gardens and arboreta historically held lands for aesthetic purposes; in many cases, these lands now represent tremendous stores of biological diversity. Now more than ever, botanical institutions play a pivotal role in promoting sustainable practices, conserving and managing natural areas, administering conservation agreements, restoring damaged ecosystems, reintroducing rare plants, banking seeds, cooperating with other conservation organizations and agencies and teaching field biologists. The Applied Plant Conservation (APC) Training Program held in Denver and this proceedings volume are primary examples of these phenomena.

This chapter focuses on the two ways in which public gardens can function as centers for conservation: through practices within the garden proper and through natural-area conservation. I use my own institution, the North Carolina Botanical Garden (NCBG), at the University of North Carolina at Chapel Hill, as an example of how a relatively small university garden can serve as a conservation organization. Our institution comprises two entities — the state university system component and our membership-support organization, the Botanical Garden Foundation, Inc. Most of our lands and facilities belong to the state and are administered as such. The foundation supports approximately one-half of our garden's operating expenses and holds conservation lands much like a land trust. Of our institution's 900 acres of state-owned lands, all but approximately 25 acres are natural areas. The foundation owns approximately 110 acres of natural area, holds conservation easements on 130 acres and manages approximately 300 acres of conservation land owned by cooperating agencies and institutions.

Our garden, through its mission — *To inspire understanding, appreciation and conservation of plants in gardens and natural areas and to advance a sustainable relationship between people and nature* — seeks to define the

conservation garden as a means of establishing our own operational standards.

This chapter is not intended to be a detailed guide for conservation garden practices. Nevertheless, many of our conservation garden activities (see the accompanying list) are discussed in this chapter. More information is available on our Web site (www.ncbg.unc.edu).

CONSERVATION GARDEN ACTIVITIES

- Conservation of native plants through propagation to prevent wild collection
- Seed banking and reintroduction
- Natural-area protection and restoration
- Invasive-species education and control
- Gardening in nature's context to promote plants that support native biodiversity
- Sustainable gardening to promote environmentally friendly gardening practices
- Supplying critical information on conservation of the flora of southeastern United States and on the garden's conservation programs
- Nurturing the people-nature relationship because plant diversity and natural areas are important to the physical and psychological health of all of us

Inside the Garden Walls

Plant Collections

We at North Carolina Botanical Garden are fortunate to have chosen native plants as our area of specialization. Native plants have always resonated with many people, but they have become particularly popular in recent years because of the public's greater appreciation of ecological landscaping and the threat of invasive species. In an effort to ensure that we not contribute to the popularization and possible spread of potential or actual invasive plants, we developed an Exotic Plant Collection Policy. Our exotic plant policy (detailed on our Web site) is formulated on the accompanying principles.

PRINCIPLES REGARDING EXOTIC PLANTS

- Plant collections of NCBG must do no harm to natural areas and native plant diversity
- Natural areas should be protected and restored by eradicating invasive exotic species
- NCBG will interpret and promote the natural diversity of North Carolina and the Southeast
- NCBG will promote the preservation of native biodiversity

Adopting and implementing this policy was relatively easy for us because native plants make up the bulk of our collections, although we were required to make a few painful choices. Our institution has had to remove a number of large and valuable specimen plants that are recognized as invasive, but the positive outcomes of adopting such a policy far outweigh the negative ecological and public relations consequences. And from our policy, NCBG Director Peter White formulated the Chapel Hill Thesis, which challenges other public gardens and the nursery industry to adopt similar measures. The elements of the thesis were the inspiration for national meetings that led to the St. Louis Declaration and the Voluntary Codes of Conduct (available on our Web site).

3 Rs + C (Reducing, Recycling, Reusing and Composting)

Solid waste disposal is a huge ecological challenge. Valuable natural resources are required for material manufacture (of paper, plastic, glass and so forth), disposal requires vehicular transport and a tremendous amount of space (via land conversion) and there are often social justice issues because landfills are more likely to be located in economically depressed areas than in affluent areas.

We try to reduce our waste at the front end by purchasing products with minimal packaging and using 100% postconsumer paper whenever possible. We strive for trash-free events and request the same of all users of our facilities. Trash-free events are realized by recycling or composting all paper products, using washable plates, glasses and silverware and recycling. (please find our user handout, "Conservation and Sustainability at the North Carolina Botanical Garden," on our Web site)

Our Visitor Education Center (which should be completed by 2009) will embody our conservation garden mission in

that it will be a platinum-level LEED (Leadership in Energy and Environmental Design) facility. The sustainable, or *green*, features of this building are available on our Web site.

Certificate in Native Plant Studies

The Native Plant Studies Certificate program provides courses in botany, conservation biology, ecology, taxonomy and local flora as well as numerous electives such as invasive-species biology, seed banking and rare plant ecology. Classes are taught by garden staff, university professors and other area professionals. The certificate training is not unlike the APC Training Program held at the Denver Botanic Gardens and has helped to train environmental consultants, Natural Heritage Program staff, restoration ecologists and others. A complete description of the certificate program and curriculum is on our Web site.

Land Conservation

Natural-Area Importance

For public gardens, natural areas serve both aesthetic and biological functions: they provide the structure and setting within which a public garden operates and they often sustain biological diversity. The increasing fragmentation of the natural landscape and the decline in species diversity continue despite the ongoing efforts of conservation organizations. Botanical gardens and arboreta, more than ever, play a critical role in conserving high-quality natural areas and helping to stitch together land patches into effective corridors for wild animals and plants.

Protected natural areas also provide, to the garden proper, buffers from noise and visual pollution, the opportunity to create low-impact nature trails and a means to effectively increase the overall area of conservation lands. Size, number and shape all matter in nature-preserve design and conservation value. Larger is better than smaller, many are better than few and circular (vs. linear) helps to reduce the edge-to-area ratio. Please refer to the literature on nature-preserve design for a more detailed treatment of this topic. Some of the references at the end of this chapter provide advice on nature-preserve design in addition to buffer creation and construction of corridors for animals and plants.

Owning Conservation Lands Outright

Fee simple ownership is the preferred choice for holding land for conservation, although availability and cost are obvious issues. Seeking land gifts and bargain sales are avenues worth exploring as well. Anticipate development pressure on lands adjacent to your institution. Develop good relationships with adjacent landowners in order to stay abreast of opportunities for land purchases or conservation agreements. You do not want to miss a land-acquisition opportunity or have an important area of open space lost from under your nose! It is also important to place permanent protection agreements on all conservation lands whenever possible to prevent land development or sale by subsequent administrations or owners.

Holding Conservation Easements or Other Conservation Agreements

Gaining conservation agreements on prime land is an obvious goal, but even areas of marginal quality can serve as buffers or restoration and/or rehabilitation sites. The goal is to add area, because size does matter in conserving biological diversity.

Creating and maintaining good relationships with adjacent landowners is important, but ownership can change hands and make your garden vulnerable to the loss of an effective buffer. Securing conservation agreements from benevolent adjacent landowners before they move on is sometimes crucial.

Many land conservation options are available to landowners who want to retain ownership but are willing to give up development rights. Conservation easements are the most common approach (and can be tailored on a case-by-case basis), but other creative options abound. Please consult with your local land trust, county conservation department or other conservation organization for advice.

It is critical that a mindful and vigilant partner hold the conservation easement (if you are not the easement holder). There are responsibilities such as management and ensuring that the conservation agreements are upheld by the landowner. These responsibilities require staff time and can stress an already overburdened staff. If possible, build in an endowment or a yearly pay-out that will help support the responsibilities of easement monitoring and management.

Natural-Area Management

Once natural areas receive some form of protection, management considerations must follow. I like to think that natural areas are self-sustaining and operate best without human interference. But with habitat fragmentation and the generally small size of many nature preserves, active management is often necessary. And many current natural areas are lands that have recovered from disruptions such as agriculture, grazing, timbering, fire suppression or exotic plant invasion — or from a combination of these — and therefore some management is essential.

Conservation staff and financial resources at most public gardens are limited and perhaps already overextended. Therefore prioritization is essential and often requires difficult choices. As the first step to formulating a plan, the staff should perform a biological inventory of all natural areas and rank these by using the hierarchical criteria from the state Natural Heritage Program or equivalent, The Nature Conservancy or a reputable private ecological consulting firm. These data should provide a starting point for prioritizing the ecological significance of the natural areas.

If significant natural communities are present, have these formally recognized as such. Strive for legal protection through a permanent conservation agreement such as a conservation easement or other legal agreements that place monitoring in the hands of a third party. A local land trust can assist with this process; the national Land Trust Alliance may be contacted for more information on conservation easements.

Some states, such as my own, support nature-preserve "dedication", which is the highest form of land protection in the state. If permanent protection is not possible, attempt Natural Heritage Program Registry or other formal recognition, which does not provide legal protection but does identify the site for its ecological significance. Registration signifies that your organization curates natural heritage sites of biodiversity importance. This designation could help to conserve these sites if they are threatened by development.

After you have identified natural areas and, perhaps, obtained protection, develop site-specific management plans that include objectives for preserve-wide management, particular species objectives and specific goals and objectives for each community type or "management unit". Management plans should be viewed as working documents that can change as new information is made available and as management experience accumulates. Have a look at various management plans from other institutions in order to get ideas on writing your own plan.

Because invasive plants present one of the greatest threats and challenges to natural-area protection and management, we have created a prioritization schedule for invasive-plant removal. This schedule identifies which invasive species to target and which areas to prioritize according to certain criteria. This document is available on our Web site.

Natural areas that require intensive management are those that depend on regular disturbance — for example, glades, early successional habitats and open woodlands. These habitats require management that maintains their open condition; they can require hand clearing, mowing and/or prescribed burning. The management plan should be written to include when and what management technique should occur. We at North Carolina Botanical Garden are fortunate to have a trained in-house prescribed-burning crew and "burn boss" that can quickly respond to favorable weather conditions, because there is often a narrow window for using fire management. We operate under the guidance of a strict burn plan that requires that we burn only under certain conditions (the "prescription"), that we have obtained all necessary permits and that all contacts are made. (Our burn plans are available upon request.) Fire training is generally available from the state or federal forest service or through The Nature Conservancy.

One of the most important aspects of a successful prescribed-burning program is to have the support of the surrounding neighbors. Our natural areas have a nearby urban interface that includes residential areas. We provide each household (thanks to the Internet and well-organized neighborhood association Listservs) information on the ecological benefits of prescribed fire including the reality that these also serve as hazard-reduction burns.

Photograph – North Carolina Botanical Garden

North Carolina Botanical Garden prescribed-burning crew that includes both staff and volunteers

In our intensively managed sites, we allow the vegetation to respond to the particular disturbance regime and control for invasive plants. If time allows, we augment these sites with appropriate plants from locally collected seed or from rescued individuals from local development projects.

Repair of Damaged Landscape

Landscape restoration, rehabilitation, reclamation and remediation represent the four Rs of reviving degraded ecosystems. Although the ecological framework for what I

lump under the general term "restoration ecology" goes beyond the scope of this chapter, some basic recommendations are included here.

Strictly speaking, *restoration* is the exact reproduction, with human intervention, of a community or ecosystem that was once present at the site. *Rehabilitation* is the establishment of some functioning ecosystem. *Reclamation* requires that some form of vegetation or ground cover be established, usually for the purposes of soil stabilization and/or erosion control. *Remediation* is the act of rectifying or "fixing" a severely degraded site and is more of a process than an endpoint.

If you are considering ecological restoration (which is actually in most cases *rehabilitation*), I recommend that you consider the large-scale or landscape-level approach that places the site objectives in the context of varying spatial scales and regional ecological processes. This approach helps to integrate the larger-scale information with community and population dynamics in the context of surrounding land uses, such as active or abandoned farmland, home landscapes and remnant woodlands.

A considerable theoretical and practical literature is accumulating around the relatively new discipline of restoration ecology. If you plan to take an ecological approach to natural-area restoration, I recommend that you consult this literature. Some approachable texts and publications are listed at the end of this chapter.

Administering University or Corporate-Owned Land

Like approximately 25 percent of the botanical gardens and arboreta in North America, North Carolina Botanical Garden is associated with a university, which gives us many opportunities and the occasional challenge. For example, many universities hold undeveloped lands, often of considerable size and with significant natural areas that may also support rare plants and/or animals. Acquiring the administration of university lands is, however, often difficult and placing permanent protection on this land can be particularly complex.

Look for all possible land-conservation strategies. One key to persuading a university, or for that manner any "corporate" body, is to show that conserving high-quality natural areas is the best and highest-value use of that land. An effective strategy for universities is to argue that natural areas support the mission of the university in teaching, research and public programs.

Another persuasive argument for forest preservation is the trees' capacity for carbon sequestration. The University of North Carolina at Chapel Hill has pledged to become carbon-neutral, which will require mitigation for unavoidable carbon dioxide release. Healthy forests on undeveloped university land with natural value can transform tremendous volumes of carbon dioxide into tons of plant parts.

In many cases, less developable lands contain steep slopes, wetlands, flood plains or stream corridors and are, therefore, easier to gain control of. These lands often have retained different degrees of naturalness by virtue of their unsuitable development potential and limited access. Obtaining permanent conservation agreements on these lands is often difficult, as university officials are commonly hesitant to permanently encumber land. On the other hand, creating secure nature preserves is one way for university officials to enhance public relations.

Rare Plants, Recovery and Seed Banking

Rare Plant Recovery

The North Carolina Botanical Garden is fortunate to be a participating institution in the Center for Plant Conservation (CPC) among (currently) 36 other botanical institutions, including Denver Botanic Gardens (see Chapter 1 for more information about CPC. CPC membership provides a wealth of resources in all aspects of rare plant recovery, although CPC's primary focus is *ex situ* (off-site) conservation. Through CPC we curate and work toward the recovery of 36 very rare plant species; we participate in active recovery projects for some of these.

Entering into a rare plant recovery project is a significant undertaking. It is important to have a good reason for attempting a rare plant reintroduction, as this action is time consuming and requires considerable resources. Reintroduction should be viewed as an experimental process and meaningful results can only be determined through careful planning, monitoring and evaluation. Approval for these projects must be obtained from the appropriate state and federal agencies and discussed with the Fish and Wildlife Service lead biologist for the species in question.

To help guide rare plant population recovery in North Carolina, NCBG helped to create guidelines for rare plant reintroduction, augmentation and transplantation.

North Carolina Botanical Garden staff in the field on the North Carolina Coastal Plain

Because of the staff and resource requirements, it is advisable to seek funding for rare plant reintroduction projects. Funding is available from various sources and NCBG is fortunate to have grants from different sources. (The National Fish and Wildlife Foundation is a current excellent organization from whom to seek funding.)

But even without external funding, most of the expense of rare plant recovery is in staff time (primarily for plant propagation, installation and monitoring). Perhaps the most effective means of aiding rare plant recovery is to augment existing populations that have suffered population decline. Candidate populations for augmentation should be on protected land and have a chance of recovery if the population number is increased. And although it is time consuming and requires many years of data, consider performing population-viability analyses on as many sites as possible.

North Carolina Botanical Garden staff monitoring the reintroduction of the federally endangered *Lysimachia asperulifolia* (rough-leaved loosestrife) on the North Carolina Coastal Plain

It is important to determine why a population has declined and what must be done to remedy the situation. For example, is an important pollinator or suite of pollinators absent? Did these pollinators depend on a particular habitat that is no longer present? Are pesticides an issue? Are there sequentially flowering species in the area to sustain these pollinators over their entire life cycle? Questions such as these must be answered prior to any reintroduction or augmentation project.

It is also important to collect seeds from the existing population for propagation. But in some cases, it might be important to introduce "new" genes from other populations if a lack of genetic diversity caused the original decline. And if new genotypes do seem warranted, then tests must be designed to determine if there is a risk of outbreeding depression to the population of interest.

Seed Banking

In addition to the relatively small volume of seed in our CPC collections, we are developing a regional seed bank in conjunction with our participation in the Seeds of Success initiative through the international Millennium Seed Bank

project sponsored by Kew Gardens, England. Our regional seed bank will support research, ecosystem restoration, native plant cultivar development and *ex situ* conservation of the flora of southeastern United States.

Other North American public gardens are also Seeds of Success participants, who together will house over 10 percent of the nation's plant taxa. Please visit the Millennium Seed Bank or Center for Plant Conservation Web pages for a list of participants and much information on seed banking in general.

Photograph – North Carolina Botanical Garden

NCBG Green Dragon volunteers collecting seeds for seed banking and restoration

Outside the Garden Walls

Cooperating with Local Conservation Groups, Municipalities, State Agencies, Developers and Utilities

In rapidly developing urban areas, public gardens act more effectively in natural-area conservation by partnering with other organizations. Partnerships nowadays are most important and helpful when seeking grant funding; through such partnerships, the expertise of other conservation professionals is tapped. If your institution has a natural-areas committee, it is very useful to include individuals from conservation organizations such as the local land trust, Natural Heritage Program, The Nature Conservancy, the National Audubon Society and others on this committee.

Local utilities often hold easements in and along garden natural areas that may create principal avenues of exotic pest plant invasion. Developing a good working relationship and collaborating to develop, for example, best-management practices for the maintenance of these easements are important for maintaining the ecological integrity of these sites or at least holding adjacent areas that do no harm.

Organizing Volunteer Groups

Most botanical gardens and arboreta depend on volunteers to bolster their work force. My garden, for example, with a full-time staff of 30, relies on approximately 250 regular volunteers — the Green Dragons — for nearly all aspects of garden operation. The Green Dragons support our natural-area conservation efforts by participating in control of invasive exotic plants, trail maintenance, fundraising, interpretation and prescribed fires and by simply providing an North Carolina Botanical Garden presence in our more public natural areas. Our Plant Propagation Volunteers process seeds and (you guessed it) propagate plants.

Effective volunteer coordination is essential and requires considerable staff time and involvement (see Chapter 4). Volunteers are typically retirees who want to positively contribute to worthwhile endeavors and enjoy the social interaction with other like-minded people. These dedicated individuals often have very busy schedules and require unambiguous and regular meeting times. Tasks must be well defined and have a clear and achievable goal and the volunteers must see the results of their work and know that their time has been well spent. At least one staff member must always accompany a volunteer group for safety, but most importantly for demonstrating that the institution truly values their help.

For NCBG, whose natural areas infiltrate suburban neighborhoods, the surrounding homeowners are effective volunteers in their efforts to practice ecologically responsible gardening. Through our garden's subscription to the local neighborhood Listserv and participation in neighborhood association meeting presentations, we enjoy strong neighborhood support in many areas. We regularly post information on invasive-plant identification and control, which has been very positively received, as many homeowners have actually removed invasive plants from their landscape. This response is particularly important, because the cultivated landscape is the primary propagule source for many of the pest plants that occur in our natural areas. And our neighbors are also good watchdogs for inappropriate activities in garden lands adjacent to their property.

Public Advocacy and Branching Out

Botanical gardens and arboreta facilities are often the home for regular meetings of local garden clubs and conservation organizations, whose programs and messages should mirror the host institutions' conservation mission. For example, when any of the local garden clubs holds a plant sale at our garden, we ask that they not offer invasive exotic species. Our institutions can also encourage the establishment of other organizations that will benefit and enhance existing programs and subsequent land conservation.

Our garden helped found a local watershed-protection group, the Morgan Creek Valley Alliance, that includes in its mission the protection and extension of NCBG natural areas. We successfully gained cooperation from the local municipalities, utilities, conservation organizations, museums and the university. The alliance has acquired considerable public membership, has organized environmental protection forums and is developing workshops on ecologically responsible landscaping.

The Botanical Garden Foundation, through the alliance, holds a 92-acre conservation easement on public land along a one-mile stretch of stream adjacent to NCBG natural areas. All of these watershed protection efforts directly benefit NCBG natural-area conservation and increase our effective boundaries.

The NCBG has also been asked to hold and manage "natural areas" by developers seeking to preserve parts of developments as permanent open space. Recognizing the various benefits and drawbacks of these offerings, we created the "Principles for Conservation Development" (also available on our Web site). These principles state that we could act as a participant, consultant or advisor if a developer chooses to enter into a formal agreement that would allow them to use our name. To adhere to the basic components of the "Principles for Conservation Development," the developer will inventory and protect significant natural areas; protect water quality; cluster development, natural areas and corridors to prevent habitat fragmentation; minimize environmental impacts; and landscape and restore areas to achieve the highest and best use for conservation. If a developer chooses not to adhere to all our standards, the developer is nevertheless welcome to use any of our suggestions in order to create a more ecologically responsible project.

Financing the Conservation Program

Financial constraints obviously limit the potential of any program. We have specific conservation accounts that are administered by the Botanical Garden Foundation. We have only one, but very active, development officer who clearly understands the NCBG mission and who is an advocate for the conservation program. We are fortunate to have received Institute for Museum and Library Services Conservation Grants, National Fish and Wildlife Foundation grants for rare plant reintroductions, Fish and Wildlife FLEX funding for rare plant seed collection, Center for Plant Conservation grants for rare plant recovery and many contributions from private foundations and private donors.

Conclusion

The APC Training Program and this proceedings volume demonstrate the increasing importance of public gardens in educating conservation biologists. Many universities have moved away from organismal biology and field courses and it is becoming more incumbent for other educational centers to accept this responsibility.

LAST MINUTE ADVICE

- Don't over extend yourself
- Have realistic goals
- Share the load
- Document your work
- Share your successes and failures
- Look for funding opportunities
- And remember: All work and no play makes one a very dull person

Recommended Reading

Journals in interest include "Restoration and Management Notes", "Conservation Biology", "Natural Areas Journal" and "Ecological Applications"

Hernández-Bermejo, J.E., M. Clemente and V. Heywood, eds. "Conservation techniques in botanic gardens" (Koenigstein, Germany: Koeltz Scientific Books, 1990). This reference contains the proceedings from an international conservation conference celebrating the inauguration of the Jardin Botanico de Cordoba.

Jordan, W.R., III, M.E. Gilpin and J.D. Aber, eds. "Restoration ecology: A synthetic approach to ecological research" (Cambridge: Cambridge University Press, 1990).

Cairns, J., Jr. "Rehabilitating damaged ecosystems" (Boca Raton, Fla.: CRC Press, 1995).

Falk, Donald A., Constance I. Millar and Margaret Olwell, eds. "Restoring diversity: Strategies for reintroduction of endangered plants" (Washington, D.C.: Island Press, 1996).

Index

Index (cont.)

Index (cont.)

Index (cont.)

Index (cont.)

DENVER BOTANIC GARDENS

UNITED STATES BOTANIC GARDEN

Denver Botanic Gardens
909 York Street
Denver, Colorado 80206, U.S.A.
(720) 865-3500
www.botanicgardens.org
www.appliedplantconservation.org