BOTANIC GARDENS
FOR PLANT CONSERVATION

Gardens can play a role in the preservation of plant species through investigations of how best to propagate, grow, and maintain them.

William L. Theobald

Botanic gardens and public and private research institutions such as museums, colleges, and universities have long played a major role in the exploration, description, and study of our world's flora, as well as the flora of Hawai'i. Botanic gardens, in particular, were initially instrumental in the assessment of plant resources from an economic point of view and were very actively engaged in the first introduction into cultivation of those species with possible economic importance. As noted in a recent publication (International Union for the Conservation of Nature and Natural Resources 1987), botanic gardens "were the forerunners of today's agricultural experiment stations."

Today that picture has changed. Living collections in gardens now emphasize: 1) the study and exploration of our world's rapidly vanishing flora from the standpoint of assessing and preserving the gene pools of wild species or relatives of cultivated species; 2) the assessment and preservation of species that may be of importance to humans for medicine, fiber, ornamentals, and so forth; and 3) the preservation of species of no known economic value that are in need of study just for their own sake. With so many rare plant habitats already disturbed to varying degrees, or in imminent danger from the world's rapidly expanding population explosion (doubling in about 30 years in the tropical regions), gardens can play a role in the preservation of plant species through investigations of how best to propagate, grow, and maintain them. Gardens provide a convenient environment for long-term studies which would be difficult to do in the wild.

Gardens can also serve as a link between botanical research and public awareness of the importance of plants. Over 100 million people a year visit botanic gardens throughout the world. Gardens provide a convenient visual image of the beauty and value of plants. Botanic gardens and other areas where native plants are preserved and managed "out of habitat" or their natural setting are commonly called ex situ conservation areas. However, gardens are not meant to be a substitute for the actual preservation of species in natural habitats.
PROGRAM EMPHASES

Programs at botanic gardens can be divided into four main areas of concern: living collections, research, education, and publications. The living collections are what everyone thinks of when discussing or describing a garden and are the single most obvious aspect. Research can range from none to a very significant part of the organization's operations (for example, Pacific Tropical Botanical Garden, Missouri Botanical Garden, and New York Botanical Garden have important research functions). Education is through public displays of plants, student training programs, museum displays, and public lectures. This is often very successfully carried out by both research-oriented and non research-oriented gardens. Publications are an important way of communicating with a vast audience which may not always be able to visit. A publications program lends credence to a garden's research or public education goals.

WORLD AND NATIONAL GROUPS INVOLVED WITH BOTANIC GARDENS

On a worldwide basis, two organizations are of particular note: the International Association of Botanic Gardens and Arboreta (IABGA) and the newly formed Botanic Gardens Conservation Secretariat of the International Union for Conservation of Nature and Natural Resources (IUCN). The latter was established in 1987, is under the direction of Vernon Heywood, and has its offices at the Royal Botanic Garden, Kew, England. Both organizations are working together to help monitor garden programs better, coordinate conservation projects, centralize record keeping, and open up avenues of communication about cultivation of unique species.

On the national level, the American Association of Botanic Gardens and Arboreta (AABGA) and the Center for Plant Conservation (CPC) are important. In Hawai'i, a number of our gardens are associated with the AABGA; the Waimea Arboretum and Botanical Garden and the Pacific Tropical Botanical Garden (PTBG) are affiliated with CPC in its national program for the conservation of a number of endangered species. In the CPC program, individual species are grown at the member institution on behalf of the CPC, and the maintenance of these species is funded by the Center. An attempt is made to grow sufficient numbers under established guidelines so as to maintain the genetic diversity of the species involved. This program is just beginning, and PTBG is attempting to set up a Hawaiian Center for Plant Conservation through private funding as an adjunct to the CPC. The forthcoming Manual of the Flowering Plants of Hawai'i (Wagner et al., in press) will serve as an important basis for this program.

HAWAIIAN EFFORTS

Botanical Gardens and Zoos

In addition to PTBG, other botanical gardens, research institutions, and individuals are attempting to collect, study, and grow Threatened and Endangered species in Hawai'i. Among these are Waimea Arboretum and
Botanic Gardens, Harold L. Lyon Arboretum, and Honolulu Botanic Gardens on O'ahu; and the Maui Zoo and Botanic Garden on Maui.

Wai'mea Arboretum and Botanic Garden, with Keith Woollams and his staff, has long been very successful with propagation of a number of rare Hawaiian taxa, including Cooke's koki'o (Kokia cookii) as well as Achyranthes spp., 'akoko (Euphorbia skottsbergii), loulu (Pritchardia munroii), and ma'ohoe (Alectryon macrocarpus). The Lyon Arboretum, under Yoneo Sagawa and his staff (especially Ken Nagata), has also been doing a fine job with a group of native plants at their site. Rene Sylva at the Maui Zoo and Botanic Garden has used native species effectively in a distinct setting.

Plants of the coastal zone (see Cuddihy, this volume) have been planted at the Coastal Garden of the Waikiki Aquarium and provide valuable messages to the public. Paul Weissich and the staff of the Honolulu Botanic Gardens, which consists of the Foster Botanic Garden and other satellite gardens, has long included rare and Endangered species of Hawai'i and elsewhere. Foster Garden is well known for its Pritchardia collection, totalling 28 species and five varieties. Ten acres at Ho'omaluhia on O'ahu have been devoted particularly to native Hawaiian species.

A large number of species (for example, 'ihau, Wilkesia hodgii, and Munroidendron racemosum) have been successfully propagated at PTBG with funding provided by CPC. David Lawrence, Botanist, and other staff have been involved. An additional area of 1.5 acres (0.6 ha) set aside in 1986 is being maintained to augment earlier successful plantings of the above species, Pritchardia spp., 'ohai (Sesbania tomentosa), and others.

Individual Contributions

Botanists at the University of Hawai'i have contributed to ex situ native species preservation through a better understanding of taxonomy, distribution, relationships, and habitat needs of various groups. Notable efforts include studies of the silversword alliance (Argyroseris/Dubautia/Wilkesia) by Gerald Carr; of ferns by Charles Lamoureux; of mosses by William Hoe; of lichens by Clifford Smith; and of 'ohai (Metrosideros polymorpha) forest dynamics by Dieter Mueller-Dombois (see Gerrish, this volume). Students who have worked with these scientists have also contributed. Preparation of the Manual of Flowering Plants of Hawai'i by B.P. Bishop Museum and U.S. Fish and Wildlife Service botanists has also contributed a wealth of information relevant to ex situ plant conservation.

Scientists on the U.S. Mainland and at European institutions are also playing a role in conservation of Hawaiian plants. The studies of Sherwin Carlquist and students at the Rancho Santa Ana Botanic Gardens; Robert Ornduff's students at the University of California, Berkeley; and the late Prof. Brenan, former Director of the Royal Botanic Garden, Kew, are just a few. Not to be forgotten are Harold St. John, the late Otto Degener, Raymond Fosberg, Beatrice Krauss, and all those past and present who have contributed both directly and indirectly to our knowledge of the flora.

Some individuals and organizations are also attempting to grow and introduce native plants into the landscape. For example, John Ohata of O'ahu has long been a leader in this area. The Native Hawaiian Plant Society, through efforts in establishment of sanctuaries and fenced areas and through public lectures and support of the Maui Botanical Garden, has done much to make the public aware of Maui's flora. Moanalua Gardens also provides valuable information about plants of O'ahu and Hawai'i in general.
DIFFICULTIES

In many instances when gardens and research institutions have attempted to grow rare and endangered species, difficulties attributable to our lack of knowledge concerning the needs of the species at the time of germination, during the seedling stage, and during their early growth phases have occurred. Recent investigations on mycorrhizae (a plant root/fungus association) at Pacific Tropical Botanical Garden by Rick Koske and Jane Gemma of the University of Rhode Island point to a possible breakthrough in understanding the role of mycorrhizae in ex situ management of some species. However, much more understanding of the species and subspecies from different locations in Hawai'i is needed.

FUTURE EMPHASES

During the remainder of this century and well into the next, a rebirth of the importance of botanical gardens from the standpoint of species and cultivar preservation will probably be seen. Emphasis will be on the unique and diverse elements of our flora, rather than on major economic plants. With this rebirth will go a need for a return to greater emphasis on the growth and survival of species in cultivation. In tropical gardens, focus will be on the interdependency of horticulture, taxonomy, ecology, mycology, and related botanical disciplines. Emphasis on all of these disciplines during collecting expeditions will be necessary. Reintroduction of some rare species into the wild will eventually increase and will benefit from knowledge acquired in the collections of botanical gardens.

Important Information Sources

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Harold L. Lyon Arboretum
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Hawaiian Botanical Society
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3190 Maile Way
Honolulu, Hawaii 96822

Honolulu Botanic Gardens
Attention: Paul Weissich
50 N. Vineyard Blvd.
Honolulu, Hawaii 96817

Maui Zoological and Botanic Garden
Attention: Rene Sylva
200 High Street
Wailuku, Hawaii 96793

Moanalua Gardens Foundation
Lorin T. Gill, Education Director
1352 Pineapple Place
Honolulu, Hawaii 96819

Native Hawaiian Plant Society
Attention: Mary Evanson
P.O. Box 5046
Kahului, Maui, Hawaii 96732

Pacific Tropical Botanical Garden
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Important References


Cuddihy, L.W. [this volume] Vegetation zones of the Hawaiian islands.

Gerrish, G. [this volume] 'Ohi'a dieback and forest life cycles.


