

Research in Botanical Gardens

Peter H. Raven

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What are botanical gardens?

Botanical gardens are by definition diverse collections of living plants. Our modern botanical gardens were begun as adjuncts to medical schools 500 years ago in Europe; physicians needed to know the identities of plants in order to use them properly for medicinal purposes, and the botanical collections that were put together for that purpose helped the physicians to attain an appropriate level of training. It is because of their origins that botanical gardens are common in universities, which are not always a congenial home for their programs today: the funding for botanical gardens must compete with that for academic programs, and the gardens are often not accepted as an integral part of the university's function.

By 1700, European botanical gardens had become large and diverse, with collections of plants from the far corners of the Earth. An encyclopedic fascination with the diversity of life had overtaken the scholars of that age, one in which the assembly of all knowledge was regarded as both good and useful. In colonial times, gardens were founded in different parts of the world to establish what could be grown to turn a profit in that setting.

The Royal Botanic Gardens, Kew, passed to public ownership in 1842, and with the addition of a herbarium that came with the first director, Professor William Jackson Hooker of Glasgow, became at the same time a center for the study of botany and a pleasure ground for the citizens of an increasingly crowded London. Kew set the model of a botanical garden as an institution that combined research, display, and education, a model that was followed 17 years later by the Missouri Botanical Garden and by many other gardens subsequently. Within 30 years of its formation as a public institution, Kew was embroiled in a controversy about whether horticultural display or research (and the kind of diverse collection of plants that would support research) should have primacy. Hooker was adamant, and diversity held sway, the flower beds being better developed in Hyde Park.

In America, almost any park or garden is termed a "botanical garden," if those who develop it want it to be called one. In Britain and most of the rest of the world, highly diverse (botanical) collections are characteristic of institutions called botanical gardens, and less diverse, more flowery and often more beautiful gardens are simply called "gardens." The APGA has been renamed aptly, because public gardens are of great importance regardless of their purpose or the motivation of those who set them up originally.

How does research relate to the botanical garden's mission?

Their highly diverse and more or less permanent collections of living plants give botanical gardens a comparative advantage in research. Individuals can be sampled for

various features, and their physiology, genetics, anatomy, and morphological characteristics can be investigated repeatedly and for many different characteristics. Botanical gardens are convenient places to assemble and grow large collections of plants for research purposes because they are good “habitats” where the plants can be grown and well maintained. Plus, it is really not cost effective for gardens to hold large collections of living plants without mounting one of many possible and appropriate research programs.

- For long-lived plants such as trees and shrubs, hybridizing them in botanical gardens, where space is available to grow and analyze the hybrids, has great value in understanding the nature of species in many groups of plants. Such experiments require the long-term maintenance of hybrid individuals, which may require many years to attain their reproductive stage.
- Coming into more prominence in recent years is the use of living collections of plants and plants assembled for that purpose for phenological or other comparative observations that can be projected over wide areas.
- Particularly noteworthy is the evaluation of the diverse collections of plants in botanical gardens as bellwethers of the forces that will come to bear on populations of plants in the future. The plants can be used to monitor climate and other environmental changes.
- Research into the development of new horticultural varieties or into the survival of species and individual strains is very suitable for the diverse collections of plants found in botanical gardens. Such research has historically been subsidized by the Department of Agriculture and has often been well developed in land grant universities.

Herbaria and Libraries

Although collections are the definitive elements of botanical gardens, much of the research that takes place in those institutions does not depend on the living collections. Large herbaria and libraries, following the model developed by W. J. Hooker, are often located in botanical gardens, but they and the staff associated with them usually do not differ in their research objectives from the botany departments in other large institutions not associated with gardens such as The Natural History Museum, London, the Field Museum, or the Smithsonian Institution. Botanists working in gardens often pay little attention to the living collections assembled outside their offices, working inside on herbarium specimens and books. In that sense, modern botanical gardens are often organizations in which the parts do not connect closely with one another.

Like natural history museums, botanical gardens are composite organizations, in which the living collections (exhibits) span the whole world of botany (although generally without extensive exhibitions on how plants function, or evolved, or occur together in ecosystems), while the research, depending on specialized, deep collections, is collectively much narrower.

Sources of Genetic Material in the Face of Extinction

In our rapidly changing world, botanical garden collections have become critically important. Two thirds of all species of plants and animals are likely to become extinct by the end of this century, and botanical gardens, with holdings that include living samples of more than a third of the estimated 300,000 species of vascular plants, are of special importance. Botanic Gardens Conservation International estimates that more than 100,000 species, a third of the world's total, are already in cultivation in botanical gardens, with a few more in seed banks. The use of botanical gardens for conservation purposes are obvious. Although genetically adequate samples may not be present in an unfortunately large proportion of these instances, having any genetic material of these plant species in cultivation is a very great benefit in view of their often uncertain future in nature.

Publicizing the plight of the world's plants and our utter dependency on them for food, shelter, and clothing is of vital significance. Unfortunately, few gardens present this message well or in ways that visitors will remember long after they have left the garden.

Whether or not the staff of botanical gardens undertake the exploration or inventory of plant diversity, either locally or on a more global basis, should depend on the local situation and the possibilities for valuable results. Once local requirements for the assemblage of diverse collections are met, smaller botanical gardens would be well advised to take up research programs that relate directly to their living collections.

A World-wide Database of Plants in Cultivation

Accumulating a sound database of plants in cultivation in botanical gardens throughout the world is the essential element necessary for increasing the use of the collections in research. As matters stand now, it is impossible to determine who has which plants in cultivation and where they are being grown. That situation is intolerable, and it means that most of the living accessions in botanical gardens will be generally ignored. There is a great deal of duplication between gardens, some of it justified; but a situation in which the duplication cannot be assessed is intolerable.

Botanical gardens are wonderful institutions, and by our diligence and clarity of thought, we can make them much more useful than they are now.

Peter H. Raven is President of the Missouri Botanical Garden and can be contacted at P.O. Box 299, St. Louis, Missouri 63166, USA.

[captions]

Raven-Herbarium

The Missouri Botanical Garden's herbarium contains more than 5.75 million specimens of mosses, ferns, gymnosperms, and flowering plants. Some date from the middle of the 18th century.

Raven-Liesner

Basic knowledge about this plant diversity is based in large part on pressed, dried specimens that have been carefully labeled, mounted, cataloged and stored in natural history collections.

Raven-Monsanto

The Missouri Botanical Garden operates the world's most active research program in tropical botany. The research division is based at the Monsanto Center in St. Louis, two blocks west of the Garden.

Raven-Research-Tibet

Many of the Garden's 45 Ph.D.-level botanists work throughout the world in a race against time to seek out, document and classify unknown tropical plants before they become extinct. This man is collecting plants on a mountainside in Tibet.