

THE SCIENCE OF URBAN HORTICULTURE: THE COMING OF AGE IN USING PLANTS IN AN URBAN ENVIRONMENT

JOHN A. WOTT

Center for Urban Horticulture
GF-15, University of Washington
Seattle, Washington 98195 U.S.A.

Changes in horticulture often appear simultaneously around the world, although significant leadership develops in specific locations. With the new science of urban horticulture, the University of Washington's creation of the Center for Urban Horticulture is already recognized for its leadership in this field.

BACKGROUND

On November 1, 1976, the University of Washington issued a comprehensive Master Plan for the establishment of a new research, teaching, and arboretum facility to be situated on the east edge of its urban campus (4). The entity actually began in 1980 when Dr. Harold B. Tukey, Jr., became its Director. Its mission was to study and define the functional uses of plants in order to maintain and improve urban environments, not only for their aesthetic virtues but as cost-effective and distinctive added values. Defining even a broad course of action in a totally new and uncharted scientific field can be both perplexing as well as exciting. Achievements to date can attest to this.

The early history and development of the Center has been chronicled in horticultural publications (1). The recruitment of faculty and staff began in 1981, and in 1984, the Center moved into the first of its new buildings situated on the site of a previous Seattle landfill. Fueled by an intense interest by the horticultural community of the Pacific Northwest, this facility now encompasses 6 new buildings and is responsible for the management of the 55-acre east campus site as well as the 200-acre Washington Park Arboretum. Even more spectacular is the fact that almost \$9 million of private funds has been raised to build and fund these efforts. And the support continues to grow.

Today, there are six Ph.D. faculty members and approximately 60 full-time staff members. In addition, there are numerous part-time employees, and a volunteer corps of 300 which does everything from weeding, guiding, cataloging, computer entry, to mounting of herbarium specimens. The Elisabeth Carey Miller Horticultural Library has 5000 volumes to serve the horticultural public and scientists of the Northwest. A Development Staff member works in funding efforts. The self-supporting Continuing Education Program reached over 25,000 people in 1987.

The following are a few program accomplishments:

ENVIRONMENTAL PHYSIOLOGY

Plant Stress Related to Root Physiology. A tree's roots need oxygen, and a deficiency of oxygen is just as destructive to plants as to animals. In work with a fast-growing popular (*Populus trichocarpa* × *P. deltoides* (Hybrid 11-11)), studies are determining how plants respond to stress. Initially it was shown that within hours after roots of a small popular were deprived of oxygen, the growth of the leaves slowed down. The researchers are looking for some chemical signal, perhaps in the form of a growth regulating hormone produced in the roots and transmitted upward in the sap, which "tells" the leaves to slow growth and conserve water (9). The extent of reduction in the final size of the leaf depended on the developmental stage of the leaf as well as the duration of the stress at the time the water stress occurred in the root zone. Results meant that even small shortages of water in the root zone of plants may have more influence on plant growth and adaptation than previously thought (7).

ENVIRONMENTAL HORTICULTURE

Selection of Street Trees. A long-term research goal is to develop rigorous criteria for selection, and management of trees for urban areas. But first, scientists must be able to characterize the specific environment around a tree. Then appropriate species can be selected. An intensive study using sweet gum (*Liquidambar styraciflua*) in 3 sites (park, plaza, and canyon) found significant growth variations. The canyon (city center corridor) site received only 50% of the amount of radiation (sunlight) found at the other two sites. Thus far, conclusions indicate the sweet gum should not be planted under plaza conditions. However, it does grow adequately under low light conditions which are often usual urban conditions (4). Future research will help us select better trees.

HORTICULTURAL TAXONOMY

Classification of Horticultural Plants. Studies have been initiated in the evolution, classification, and nomenclature of plants of present and potential landscape significance, particularly of the Pacific Northwest. The new Otis Douglas Hyde Hortorium is the second herbarium collection in the United States devoted to horticultural plants. The 60-year old collection of trees and shrubs of the Washington Park Arboretum is now being re-evaluated. Special studies of plants such as *Escallonia* and *Drimys*, two species with landscape potential, have begun.

New Plant Introduction. Introduction of plants from areas of the world with a climate similar to the Pacific Northwest have begun through field studies in south-central Chile and central New Zealand. With further global emphasis on water conservation as

well as native vegetation, the importance of environmentally tolerant species will increase. But often germplasms already known are overlooked, and/or need to be collected anew.

Climate Analysis. The analysis of climatic factors that determine plant success (whole-plant physiological ecology), e.g. annual minimum temperature, absolute precipitation, annual precipitation pattern, timing, and severity of drought, have culminated in studies which have used the Walter System in initially selecting potential plants (2). The importance of microclimate for plant adaptation cannot be overlooked in future selection processes.

URBAN ECOLOGY

Air Pollution Studies. News media continually emphasize the changes occurring in the earth's environment. Our urban populations continue to grow, our fossil fuels continue to turn out large amounts of carbon dioxide into the atmosphere, and the earth's ozone layers continue to increase. Scientists are now speculating as to what is happening to our planet and what affect this will have on humans as well as plants. In order to understand this, scientists must begin to understand what is happening in smaller areas. The significance of plants in our possible environmental stabilization is of utmost importance (11).

Urban Interface. Do we really know what happens when we build a new home in a forested area? Do we know how much lawn area we have in each city? How does this affect the need for water? Can trees and shrubs really purify the air? Even though each of us may only be concerned with a small yard or garden, what happens when you add a city block, then expand this to a neighborhood, onto an entire community, or even larger.

With the advent of computer technology, studies can be instituted on entire ecosystems as well as each of its parts, e.g. parks, gardens, and open spaces. Ecology has never been applied to these types of urban systems. Ultimately the results of these studies could have a great impact on the number or type of plants we should be producing and consequently planting in our urban environments.

PLANT COLLECTIONS

Plant Collections. Washington Park Arboretum contains over 5,500 taxa which can be grown in the Mediterranean Northwest U.S.A. climate. Renewed emphasis is being placed on updating these collections for field as well as laboratory research. Although emphasis will be on plants for northwest conditions, a collection policy including plant conservation and education has been established. Renovation projects have already begun in the Arboretum, and display gardens at the east campus site are being planted. Horticulture in the northwest includes a much broader interest in natural history and environmental issues (3).

PEOPLE-PLANT ISSUES

In a study of four area transit parking lots, problems were identified in the original design and in the construction practices, all of which influenced the future management strategies for these lots. Long-term maintenance problems could be avoided with proper plant selection/specification review and maintenance requirement/cost projections during the design stage (8).

Another study investigated the possible aesthetic thresholds at which professionals, rhododendron enthusiasts, Master Gardeners, and the general public would tolerate rhododendron leaves damaged by the feeding of the rhododendron root weevil. In all instances, there was little tolerance for insect damage. The groups did have different aesthetic thresholds for taking any type of action and/or using a chemical application. This knowledge could have future implications as integrated pest management programs (IPM) are instituted (6).

PUBLIC SERVICE AND CONTINUING EDUCATION

Education. In 1987, over 25,000 people attended horticultural classes, lectures, tours, special seminars, and exhibits in our facilities. All of these activities are self-supporting. There are 100 plant societies, 400 garden clubs, and over 50 horticultural-related professional organizations in the area. Cooperative efforts with other groups on activities has lead to programs with retail food importers, public utilities, open-space planners, land developers—all truly urban utilizers of plants. In the Arboretum, weekly tours led by a corps of 200 trained volunteers, offer insight to visitors. Horticultural Support Organizations provide not only enthusiasm and “people-power” but have raised as much as \$44,000 in a single plant sale. The intensity of interest in horticulture and the environment is exceptional.

Conference Facilities. The 220-seat Conference Hall, adjacent classrooms, and the Graham Visitors Center in the Washington Park Arboretum, are now used by over 40,000 visitors per year for all types of activities. Conference facilitators help the organizations arrange for meetings as well as special shows. All users pay a fee.

ADDITIONAL AREAS OF EMPHASIS

Additional faculty positions are anticipated in the areas of pest management and horticultural psychology. The ideas of integrated pest management and the need to safely control pests in our urban environment is of utmost importance. Recent studies also point out the importance of plants in our homes, our offices, and even in our hospitals. Putting together research teams of psychologists and horticultural scientists to conduct precise studies will continue to be a challenge for the future (10).

FUTURE

The success of the Center for Urban Horticulture in such a short period of time is astounding. Starting at basic research levels, both from a plant and human viewpoint, and continuing on to whole plant interactions, adaptations, and selections, these studies will continue to be of utmost importance as we enter the next century. Making the best use of any of this information and getting it to our public is always a challenge for a major university.

Through the use of scientific studies, we are now proving that plants do enrich human environments in many ways. The challenge is to decide which ones, in which place, and by whom. The Center for Urban Horticulture will continue to pursue these efforts through excellence in research, teaching, and continuing education.

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