JOURNAL OF
ARBORICULTURE

October 1981
Vol. 7, No. 10

CURRENT TRENDS IN NORTH AMERICAN UNIVERSITY ARBORICULTURAL EDUCATION

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Abstract. Surveys conducted in 1979-80 revealed that courses incorporating major arboricultural content and curricula emphasizing arboricultural subjects were offered at 27 North American universities. Nineteen courses and 12 curricula were provided at the undergraduate level and 4 courses and 2 curricula were available to graduate students. Several new courses are planned for both levels. Current and proposed university arboricultural opportunities should meet the educational and continuing training needs of the North American shade-tree industry. University research and development activities, however, should be strengthened to support arboricultural science programs, especially at the graduate level.

Virtually every monthly issue of the 1980, Volume 6 Journal of Arboriculture carried one or more articles describing municipal arboriculture or urban forestry. As part of this literary array, eight papers and notes specifically explored arboricultural education (Bilderback 1980, Dubyk 1980, King 1980a and 1980b, Knudsen 1980, Merrill 1980, Monreau 1980, and Nobles 1980). Earlier educational commentaries are found in 11 primary, arboricultural articles in Volumes 1 to 5 of the same Journal.

Quality and quantity improvements in arboricultural education have progressed at a steady rate since Andresen's (1977) review of university arboricultural education in North America. King (1980c) also summarized the role of education in urban forestry-arboriculture at the 1978 Washington, D.C. National Urban Forestry Conference. He commented on the relationships between university responsibilities, student preparation for the job market, and employment opportunities. He found the system to be well balanced.

High quality education is also an International Society of Arboriculture (ISA) concern. With educational improvement as one of the motives, the former ISA Urban Forestry Committee and the earlier Municipal Arborists Association have amalgamated to form a new special interest group: Municipal Arborists-Urban Forestry Association (MAUFA), ISA. Within MAUFA is an active subcommittee devoting its attention to arboricultural and urban-forestry education. Reinforcing this endeavor and adding its own expertise is the Arboricultural Research and Education Academy, ISA. On-going projects of these well-informed and highly-active groups portend even greater advances and sophistication of university arboricultural education.

ISA conferences, which serve as educational forums, annually feature papers and sessions relating to arboricultural education. As a recent example at the 1979 international conference, Nobles (1980) presented a paper which described the arboriculture-urban forestry program of the USDA Forest Service. Among projects contracted with consultants was one concerned with an "Inventory of urban-forestry educational curricula." Subsequent to the ISA San Diego Convention a number of arboriculture educational leaders, including past president Gordon King, suggested that the project also include university arboricultural and landscape architectural courses and curricula. Heeding this advice, the study was then expanded to accommodate arboriculture concerns. The following paper summarizes the resultant 314 page report (Andresen 1980) "North American Urban-Forestry Educational Perspectives including a Catalogue of Urban

[1]This report was sponsored by and is on file at the Pinchot Institute for Conservation Studies, Milford, Pennsylvania 18337.

Forestry and Arboricultural Courses.[1]" And in this instance it places special emphasis on contemporary arboricultural course and curricula offerings leading to a model course outline (Appendix 1).

Earlier Studies

North American university arboricultural education was reviewed in 1975 by the Urban Forestry Committee of ISA and was summarized by Andresen (1977). At that time arboriculturally oriented courses were offered in at least 52 North American university horticultural schools. As part of the updating procedure on arboricultural education called for by Gordon King, a survey of the 1976-79 issues of HortScience revealed no further analysis or discussion of ornamental horticulture education (including arboricultural education) and related topical urban-oriented technology transfer subjects. This is in contrast to at least 14 papers from 1970 to 1974 (Andresen 1977, Andresen and Jorgensen 1975). In addition arboricultural education was not formally discussed at any of the annual meetings of the American Society of Horticulture which was in antithesis to a number of presentions at meetings in the early 1970's.

On the other hand, as indicated earlier, several articles examining contemporary arboricultural education have appeared in ISA's *Journal of Arboriculture.* Sydnor (1979) in his description of arboricultural instruction at Ohio State University presented three alternative options of study, incorporating various internship durations, leading to a university degree in arboriculture. The programs are especially suitable to students desiring a maximum of practical training as a complement to academic classroom fundamentals.

King (1977) wrote on the principles of education in arboriculture commenting that academic requirements are quite similar for students interested in urban and recreational forestry as well as in arboriculture. King (1979) in a summary of one of his research projects offered three solutions to a problem he saw as poor communications between universities and colleges, educators and administrators, students, and potential employers, in the fields of arboriculture and urban forestry:

- Educators and administrators must be made aware of the field of Arboriculture/Urban Forestry and the support and job opportunities possible.
- Students should be advised as to what courses are necessary and the need for work experience prior to coming to school as well as while in school.
- There must be cooperation between educators, students, and employers in coordinating a workable program.

Survey Results

A second part of the 1979 Forest Service study (the first part dealt with urban-forestry education) leading to the present paper, included a survey of North American horticultural, landscape architectural, and related departments to determine arboricultural offerings. As mentioned earlier, Andresen's (1977) paper on university arboricultural education indicated that 52 schools were offering arboricultural education but it should be emphasized that the list included all courses that in whole or part were concerned with urban plant design and materials as well as arboriculture. A 1979-80 distillation, by means of a questionnaire, correspondence and telephone calls, of the earlier course list was designed only to include special courses in arboriculture. Nineteen arboricultural courses and 2 curricula were provided at 27 North American universities. These undergraduate offerings were complemented by 4 graduate courses and 2 curricula. Respondents advised that several new courses are planned for both program levels.

In comparing urban-forestry and arboricultural education at the curriculum stratum, it was found that undergraduate and graduate arboricultural curricula are more variable in structure than urban-forestry options. Arboricultural curriculum development has had a longer history and more complex pattern of evolution than the majority of the more recent urban-forestry curricula. Often elements of landscape architecture and design are included with the arboricultural options which are strongly oriented toward individual, cultivated-tree care. Further, arboricultural students receive more course work in the maintenance and care of

turf; annual and perennial bedding-plant selection and propagation; and intensive irrigation, fertilization and pesticide management.

When the arboricultural candidate enters graduate study, program emphasis often revolves about a plant physiological investigation rather than a broader urban-vegetation management exercise.

Specialization in arboricultural education at the undergraduate level is less frequent than special urban-forestry programs but nonetheless arboricultural offerings are found in the universities of major geographic regions of the United States and several are designed to complement or be part of urban-forestry curricula.

Curriculum Examples

A few curricula are outlined here as examples of the new thrust in arboricultural education:

Professor R.W. Harris, Chairman of the Department of Enviromental Horticulture advised (1979-05-15)[2] that urban-vegetation management specialization for students enrolled at the Davis Campus of the University of California is incorporated within the landscape horticulture option of the plant science curriculum. This option includes courses in park administration and management, design of recreation environments, taxonomy and ecology of environmental (urban) plants and management of container soils.

Offered as four-year major, park administration at California State Polytechnic University, Pomona, centers about the operation of city parks. The pragmatic justification for this urban park emphasis is "...because of greater job opportunities there (in the city)..." (California State Polytechnic University 1980). The program is strong in horticulture and managerial courses.

Urban horticulture (arboriculture), at the University of Illinois, is offered by the Department of Horticulture through its four-year curriculum in ornamental horticulture. Courses include basic horticulture, landscape architecture, plant protection, and at least 15 hours in the humanities and social science. Graduates find employment as city arborists, urban park superintendents, and grounds superintendents for a number of services that maintain urban vegetation and utility-line rights-of-way.

A four-year arboricultural curriculum is Cornell University's response to urban-vegetation management needs. This program is given by the Department of Floriculture and Ornamental Horticulture at the New York State College Agriculture and Life Sciences. The curriculum combines a wide array of courses within the fields of floriculture and ornamental horticulture, landscape architecture, plant pathology, entomology, agronomy, plant biology, and land and agricultural economics.

In the eastern heartland of arboriculture and the nursery-trades industry, Ohio State University's Department of Horticulture offers a number of four-year programs appropriate to urban-vegetation management. Among these would be the nursery and arboriculture program within the landscape horticulture option. Upon completion of Ohio State's program the graduate is suited, among other positions, to serve as a municipal arborist, and in that role to solve problems peculiar to urban environments and to maintain trees and shrubs in man-made landscapes.

Nursery management is the urban-vegetation management option taught at Oklahoma State University within its Department of Horticulture. Course work stresses the management, production, installation, and maintenance of trees, shrubs and vines all of which could be found in an urban setting. Outside of the horticultural and general basic courses, recommended electives can be taken in business administration and business law, finance, accounting, management and marketing.

Similar to Ohio State's nursery and arboricultural program and Oklahoma State's nursery-management option, the Department of Horticulture at Pennsylvania State University (which also offers a great range of four-year options) provides urban-arboricultural education within its nursery culture track for horticulture majors. Among courses available to the student (standard offerings in horticulture are given) an entry that should be included in all urban-forestry and urban-horticulture (arboriculture) curricula is plant pathology 424: environmental pathology (3). It is

[2]Personal correspondence with author

concerned with the nature, origin, effects and control of environmental stresses that cause woody plant diseases — in short urban physiogenic tree diseases.

By taking research problems, and/or a master thesis or doctoral dissertation, a graduate student can further specialize in some aspect of advanced arboricultural sciences. Almost any of the foregoing schools or departments can construct a student's graduate program from existing graduate courses and local research opportunities.

One particular graduate program that warrants discussion is a joint endeavor combining resources of the University of Delaware and Longwood Gardens at Kennett Square, Pennsylvania.

Longwood graduate fellowships granted by the Longwood Foundation assist two-year graduate students to earn a degree of master of science in ornamental horticulture with a specialization in public garden administration. Since most arboreta, botanical gardens, and park systems are either urban or peri-urban in location, the career preparations given with the Longwood program are geared to public programs and provide a unique background to meet and master urban challenges.

Again, both undergraduate and graduate curricula in arboriculture are more diverse than those in urban forestry, are among sub-programs offered in large horticultural departments, and have a primary base in the horticultural sciences.

Conclusions

In relation to arboricultural education in general, it is the author's opinion that current and planned arboricultural educational opportunities are more than adequate to meet the educational and training needs of commercial, municipal, and utility arboricultural management organizations. Based upon a consolidaton of existing arboricultural courses and the thoughts of their instructors, a model course outline of arboricultural principles is provided (Figure 1) for the reader's consideration. Research and development activities, however, should be strengthened to support educational and management programs especially at the graduate level.

Generally, arboricultural curricula and courses are maintaining their effectiveness to serve socially-oriented vegetation-management programs. Their greatest impact, however, may be at the adult-education level and in particular for home owners and nature enthusiasts. There are many more community-college-level ornamental-horticultural programs that emphasize urban trees and gardens than four-year options in arboriculture and decidedly more than university urban-forestry programs, but collectively the North American public and its professional arborists and urban foresters are well served by our universities.

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Appendix 1

Arboriculture principles. Model-course outline for a ten-week course including lectures and laboratories.

Lectures

1. Orientation
   a. Arboriculture in history
   b. Arborists in today's society
   c. Contemporary arboricultural practices
   d. Arboricultural communications systems and technology transfer
2. Landscaping with Woody Plants
   a. Landscape design principles
   b. The arborist-landscape architect team
   c. Trees and shrubs in the city
   d. Indoor foliage plants
3. Plant Selection
   a. Genetic variation
   b. Environmental conditioning
   c. Breeding and selection
   d. Nursery practices
4. Planting-Site Characteristics
   a. Macro-meso-micro climatology
   b. Natural and urban soils
   c. Soil preparation and amendments
   d. Site-approval or reflection criteria
5. Fertilization and Irrigation
   a. Nutritional and moisture requirements of woody plants
   b. Irrigation systems and costs
   c. Fertilizer regimes and costs
   d. Lawn fertilizer mixes and incompatibilities
6. Cultivation
   a. Composting systems
   b. Organic and inorganic mulches
   c. Mechanical cultivation and aeration
   d. No-cultivation systems
7. General Maintenance
   a. Classical tree surgery — myths and realities
   b. Pruning techniques and schedules
   c. Wound and cavity physiology and treatment
   d. Chemical growth retardants
8. Wood Plant Diseases and Insects
   a. Non-infectious or physiogenic diseases
   b. Pathogenic diseases
   c. Insect pests
   d. Bird, mammal and related tree antagonists
9. Preventive Care and Maintenance
   a. Protective tree by-laws ordinances and related legislation
   b. Prevention of construction damage
   c. Conservation of essential trees and woodlands
   d. Integrated pest control
10. Diagnostics and Valuation
    a. Diagnostic techniques to determine causal agents of tree injury
    b. Evaluation report and corrective recommendations
    c. Valuation techniques and equation formulae
    d. Consulting arboriculture

Laboratories

1. Calibration of environmental site conditions. Observations and use of instruments to determine inimicable factors in a planting site.
2. Established planting evaluation. Visit to an indoor-outdoor commercial or public building complex to evaluate successes and failures of woody plants and establishment methods.
3. Nursery inspection. Visit to a large commercial nursery to observe greenhouses, lining-out beds, container operations, and handling and shipping techniques.
4. Tools and equipment. Familiarization and demonstration of hand and power tools as well as large mobile equipment used by arborists.
5. Elements of tree surgery. Familiarization and demonstration methods and techniques of rope work, tree climbing, pruning, cavity work, cabling and bracing, and tree takedown.
6. Commercial arboriculture. On-site visit to observe set-up, safety procedures, tree work, and clean-up.
7. Pesticide application. Demonstration of spraying equipment, formulation and mixing of pesticide and fertilizer solutions, tree injection techniques, and safety precautions.
8. Diagnostics. Inspection and malady diagnosis of a variety of declining and dead trees. Use of diagnostic equipment. Preparation of a report.
9. Tree inventory. Feasibility study, survey techniques, computerization methods, data compilation and preparation of report.
10. Bidding and tendering procedures. Technique and method of estimating fees and client costs for different arboricultural jobs: planting and maintaining a 6 cm caliper tree, pruning and thinning a 20 m tree crown, and taking down and removing a 30 cm diameter tree.

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