

UNIVERSITY ARBORICULTURAL EDUCATION IN NORTH AMERICA¹

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Abstract

In 1975, the Urban Forestry Committee of the International Society of Arboriculture made a survey that revealed arboriculturally oriented courses were offered in at least 52 North American University Horticultural Schools. Titles of these courses as well as related curricula are listed. Comments are also given on 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. Research and development activities, however, should be strengthened to support educational and management programmes.

Educational Requirements

Vegetation management systems designed to enhance man's environment often include specialized arboricultural programs. These programs, which emphasize the care of trees, shrubs and associated woody vegetation are dependent upon knowledgeable, well-trained arborists. Of the several levels of arboricultural education offered in Canada and the United States five will be discussed: education principles by Gordon King; teaching methods and techniques by Clark Eads; the community college approach by Richard Hook; extension education by John Weidhaas; and the present paper concerning courses and curricula offered at four-year and graduate level institutions.

Arboriculture, like many of its kindred forestry and horticultural pursuits, is in a state of constant ecological and technological evolution. Further adaptation to urbanization involves a dynamic series of processes that improve management practices within the fields of commercial, municipal, and utility arboriculture.

Ultimate goals of these three specializations and the complementary discipline of urban forestry are to provide economically and environmentally sound vegetation management programs and practices that have favorable long range effects. All of our efforts, however, are contingent upon dexterous manipulation of, and

carefully coordinated interaction between eight occupational functions that are essential to arboricultural management systems. The functions listed here not only apply to our interests but are found in most organizations from one-man enterprises to national governments; they are: information exchange, research, planning, development, regulation, financing, appraisal, and review. Many organizations and individual authors have explored and published on the foregoing but today let's emphasize the topic of education which is a major component of information exchange.

Academic Responses

A wave of concern for modernizing university agricultural and natural resources education programs began in the '60's (Committee-Educational Agricultural Natural Resources 1967, Frazier 1965, 1969, Mahlstede 1970) with questions about course content, mission relevance, job opportunities professionalism, and accelerating educational change.

By the early 1970's environmental science overtones dominated ornamental horticultural and arboricultural education as witnessed by several symposia and other papers (Denison 1972, NSB 1971, Beattie 1970). Social responsibility and program accountability were in vogue by 1972 (Day 1972, Wittwer 1972, Rollins 1972), so arboricultural students and their professors were told by their deans to develop greater empathy toward their fellow man, to conserve resources, and to work longer, harder and more effectively.

When the university expansion bubble burst in the mid-'70's, terms as retrenchment, consolidation, resource pool, cooperation intensification, etc. at both national and international levels became common in collegiate rhetoric (Bishop 1974, Chandler 1974, Gableman 1974, Leach 1974, Roberts 1974).

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Inventories of programs on a national scale were also initiated so revised programs could be prepared with the hope of eliminating unnecessary duplication in courses, curricula or personnel (AAN 1975, Childers 1973, 1974). Educational challenges faced by our sister profession, landscape architecture, were similarly reviewed (Fein 1972 and Newton 1974).

The foregoing documentation provided an indication of trends in horticultural sciences education but did not specifically explore those baccalaureate or graduate programs emphasizing arboriculture and environmental, ornamental or urban horticulture.

Arboricultural specializations as we all know are diverse and highly sophisticated; further, educational offerings vary considerably among the 78 degree-granting institutions in North America (Baumgardt et al. 1971). Degrees awarded, with a predominant emphasis on science, may be at the rank of bachelor, master, or doctor of science.

ISA's Concern

ISA's response to all of the above was interrogatory. Aware that specific information was needed for educational review considerations, former president John A. Weidhaas, Jr. of the then International Shade Tree Conference, Inc. convened an urban forestry committee (UFC) in 1973 with one of its specific tasks to investigate "... prerequisite training and qualifications for urban foresters and arborists"¹. His charge led to a survey² of North American university plant science and design schools to determine what offerings were available in arboriculture and related management areas. In addition the UFC wanted to learn what programs were specifically oriented to urban challenges and opportunities. Thus a recent paper on urban forestry education in North America (Andresen and Williams 1975); the present review of university arboricultural education in North America; the Directory of American Horticulture (Baumgardt et al. 1971); and ongoing studies by the American Society of Landscape Architects' Foundation (Robinette

1971) provide a contemporary course and curriculum inventory of the three major groups of academic departments concerned with arboricultural activities, namely: forestry, horticulture, and landscape architecture.

To gain the data for the current paper, a questionnaire entitled "Urban vegetation, management education programs" was mailed on 1 Feb., 75 to administrators of North American four-year and graduate schools offering instruction in ornamental horticulture. To augment the survey, further correspondence was initiated and personal visits were made to horticulture schools and departments. In addition current university catalogs were examined for course and program listings. Some omissions may have occurred but it is hoped that a nearly complete inventory was obtained.

Survey Results

Clear recognition of courses featuring an arboricultural orientation is clouded if course titles alone are to be judged. Even university course descriptions are deceptive in revealing an accurate account of course content regarding arboricultural subject matter. With the foregoing constraints in mind, the following analysis (based on survey results and other documentation) illustrates courses either featuring arboriculture or placing emphasis on arboricultural practices. Here Hirt's (1974) definition helped establish a standard or criterion; "Arboriculture is the area of endeavor concerned with the scientific cultivation and care of trees and shrubs used mainly for shade and ornamental purposes. Its emphasis is on the individual woody plant even in large ornamental plantings . . .".

The following enumeration of course titles and contents is not all inclusive at every level of arboricultural education: 1) an absolute review of all courses and programs was not feasible, 2) vocational, technical and certificate courses covered by our other speakers are not listed, and 3) a complete response to the UFC mail survey was not attained. However, the following commentary provides the reader with the majority of

¹ Weidhaas, J.A., Jr. 1973. Correspondence to members of the ISTC Urban Forestry Committee. International Shade Tree Conference, Inc., Urbana, Illinois. 2 p.

² The UFC is grateful to the ISA Executive Committee for fiscal assistance to conduct the survey.

course title identifications used in North America. As with urban forestry education program course titles (Andresen and Williams 1975), nomenclature of arboricultural courses varied between universities and did not seem to have regional or temporal affinities.

Arboriculture, as an official course title was used at eleven of the horticultural schools reviewed. To this we should add the arboriculture course offered by the Forestry Faculty at Michigan State University. It might be recalled that this course title was used (and has had continuous usage at East Lansing for over 50 years) by the pioneer arborist Karl Dressel in the mid-'20's when he taught at Michigan Agricultural College. Dressel, it will be recalled was the only man to hold the International Shade Tree Conference office of president for three consecutive terms: 1938-1940. At least 17 other course titles are used by 34 university horticultural schools or departments to denote courses featuring conventional or innovative arboricultural content. A number of courses stress care and maintenance: *arboriculture and maintenance* (Penn. State); *care and maintenance of ornamental plants* (Auburn); *establishing and maintaining the landscape environment* (Conn.); *home grounds* (R.I.); *landscape maintenance and construction* (Tex. A. & M.); *production and maintenance of woody plants* (Md.); and *woody plant maintenance* (Southern Illinois). Courses featuring taxonomy and tree care are: *landscape plant materials* (Maine); *ornamental horticulture* (Vt.); *ornamental trees* (Cal.-Fresno); *plant materials for landscape use* (Va. Poly.); *special ornamental plants* (La. State); *trees of the United States* (Cornell); and *woody landscape plants* (Arkansas). Two schools (plus Conn. above) emphasize environmental issues: *horticulture in the residential environment* (Rutgers); and *relationships of ornamental plants to the urban environment* (Fla.).

Curriculum and program option titles usually cluster about horticulture and use modifying adjectives *amenity* (Mass.); *environmental* (Cal.-Davis); *landscape* (Idaho, Minn., Ohio State, and Oregon State); *ornamental* (Cal. Fresno, Cal.-San Luis Obispo, Fla., E. Ky.) and *urban* (Ark., So. Ill.). Cornell offers a custom built arboricultural option at the B.S. level and many horticultural depart-

ments offer M.S. programs using research or thesis credits that concentrate on arboricultural topics.

Table I summarizes professional arboriculture (and related) courses and curricula currently offered at three Canadian and 49 American horticulture schools. Most of the courses listed are offered in the junior or senior year, average about three hours a week per academic quarter or semester, and are in an elective category. Undergraduate enrollment at individual schools is about 30 per course. At the graduate level, courses usually consist of seminars with five to ten students enrolled.

In almost every instance, at universities that have responded to environmental and urban challenges, definitive action to establish cross-disciplinary cooperation is evident. Program elements shared within forestry, horticulture, landscape design, urban and regional planning, social sciences, the humanities and managerial sciences have been and are being incorporated into arboriculturally oriented curricula.

Accurate statistics are not available to estimate the numbers of four-year and graduate students who claim arboriculture as a major, but the arboricultural ethic threads through the professional fabric of several hundred graduates per year who were enrolled in the courses and curricula outlined above. Influence of these new urban arborists is being felt as better selection of environmentally realistic woody-plant materials are being incorporated in metropolitan planting plans. Further, advanced maintenance techniques are increasing survival and growth rates, reducing costs, conserving energy and adding to composite amenities requisite to the well-being of North Americans.

Since the publication of the urban forestry education paper by Andresen and Williams (1975), additional arboriculture and urban forestry courses and curricula have been initiated or are being planned. Robert S. Dewers, Professor of Urban Forestry (including Dewers, at least three academicians now hold the title — J.C. Calahan at Purdue and Andresen at Toronto) distributed a Texas A & M University Department of Forest Science brochure at the 52nd ISA annual convention. The publication describes new

TABLE 1

North American horticultural schools offering arboriculture, ornamental and urban horticulture, and related instruction at the university baccalaureate or graduate student level.

University	Contact	Current				Planned				Instructional Materials Available
		Courses		Curriculum		Courses		Curriculum		
		U.G.	G.	U.G.	G.	U.G.	G.	U.G.	G.	
Alberta	R.H. Knowles	+	-	-	-	+	-	-	-	+
Arizona State	V.J. Miller	+	-	+	-	-	-	-	-	+
Arkansas	G. Klingamen	+	-	+	-	-	-	-	-	+
Auburn	D.Y. Perkins	+	-	+	-	-	-	-	-	+
Cal. Davis	R.W. Harris	+	-	+	-	-	-	-	-	+
Cal.State Fresno	H.P. Karle	+	-	+	-	-	-	-	-	+
Cal. State San Luis Obispo	H.C. Brown	+	-	+	-	-	-	-	-	+
Cal.State Pomona	J. Carter	+	-	+	-	-	-	-	-	+
Clemson Univ.	F.W. Thode	+	-	+	-	-	-	-	-	+
Colorado State	K.M. Brink	+	+	+	-	-	-	-	-	+
Connecticut	E.J. Duda	+	-	+	-	-	-	-	-	+
Florida	J.W. Strobel	+	+	+	-	+	+	-	-	+
Guelph	A.J. Hilton	+	-	+	-	-	-	-	-	+
Hawaii	D.P. Watson	+	-	+	-	-	-	-	-	+
Idaho	A.A. Boe	+	-	+	-	-	-	-	-	+
Illinois	J.G. Gartner	+	+	+	-	-	-	-	-	+
Iowa State	C.V. Hall	+	+	-	-	+	+	-	-	-
Kansas State ¹	F.J. Deneke	+	+	+	-	-	-	-	+	+
Kentucky (Eastern)	W. Householder	+	-	+	-	+	-	+	-	+
Louisiana State	D.W. Newsom	+	-	+	-	-	-	-	-	+
Maine	J.E. Swasey	+	-	+	-	-	-	-	-	+
Maryland	F.R. Gouin	+	-	+	-	-	-	-	-	+
Massachusetts	G. King	+	-	+	-	-	-	-	-	+
McGill	C.D. Taper	+	-	-	-	-	-	-	-	+
Michigan State	H. Davidson	+	+	+	-	-	-	-	-	+
Minnesota	V.A. Lerch	+	-	+	-	+	-	+	-	+
Missouri	R. Rothenberger	+	-	+	-	-	-	-	-	-
Missouri State	C.C. Singletary	+	-	-	-	-	-	-	-	+
Montana State	G.E. Evans	+	-	+	-	-	-	-	-	+
Nebraska ¹	W.T. Bagley	+	-	+	-	+	-	+	-	+
Nevada	R.A. Young	+	-	+	-	-	-	-	-	+
New Hampshire	L.C. Pierce	+	-	+	-	-	-	-	-	+
New Mexico	D.J. Cotler	+	-	+	-	-	-	-	-	+
New York (Cornell)	G.L. Good	+	-	+	-	-	-	-	-	+
North Carolina St.	J.W. Strobel	+	-	+	-	-	-	-	-	+
North Dakota St.	E.P. Lana	+	-	+	-	-	-	-	-	+
Ohio State	I.D. Sydnor	+	+	+	-	+	-	+	-	+
Oklahoma State	C.E. Whitcomb	+	-	+	-	-	-	-	-	+
Oregon State	A.N. Roberts	+	-	+	-	-	-	-	-	+
Penn. State	R.W. Hepler	+	-	+	-	-	-	-	-	+
Purdue	H.L. Flint	+	+	+	-	-	-	-	-	+
Rhode Island	W.E. Larmie	+	-	+	-	+	-	+	-	+
Rutgers	R.H. De Boer	+	-	+	-	-	-	-	-	+
Saskatchewan	S.H. Nelson	+	-	+	-	+	-	+	-	+
Southern Illinois	G.D. Coorts	+	-	+	-	-	-	-	-	+
Texas	J.L. Hepworth	+	+	-	-	+	-	+	-	+
Texas A&M	R.H. Rucker	+	-	-	-	-	-	-	-	+
Utah State	K.W. Hill	+	-	-	-	-	-	-	-	+
Vermont	S.C. Wiggins	+	-	+	-	+	-	-	-	+
Virginia Poly.	P.L. Smeal	+	-	+	-	+	-	-	-	+
Washington State	W.B. Ackley	+	-	+	-	-	-	-	-	+
Wisconsin	E.R. Hasselkus	+	+	+	-	+	-	+	-	+
Total: 52	52	52	10	45	0	13	2	7	1	50

U.G. — undergraduate

G. — graduate

1 — Faculties of Horticulture and Forestry.

urban forestry programs at both undergraduate and graduate levels with F.S. 420-Arboriculture and F.S. 421-Urban Forestry among the core courses. It has also been learned that the Department of Forestry and Wildlife Management at the University of Massachusetts now offers an undergraduate option in "environmental-urban forestry" and Professor R.H. Greffenius, Department of Natural Resources Management, California Polytechnic State University at San Luis Obispo wrote of a new course, NRM 434-Urban Forestry. From Clemson University, Professor D.L. Ham, Department of Forestry advises of a feasibility study to offer urban forestry. And Professor A.R.C. Jones, Coordinator of the Renewable Resources Development Curriculum at MacDonald College of McGill University, Quebec reports a new Landscape major that includes several urban vegetation management courses. Last but far from least, my colleague Professor Gordon King reminded me of the new Park Administration major given within the University of Massachusetts Department of Landscape Architecture and Regional Planning. Among the featured courses is his PA 231-Principles of Arboriculture.

Discussion

Chadwick (1941) and Hirt (1974) stress that nothing less than four years of education and practice at a recognized college or university could properly prepare an aspiring arborist. However, a collegiate education, for many, is becoming prohibitively expensive and arduous to the extreme. What then are the advantages of four years of university attendance? It seems that there are at least four:

Since no North American university offers a B.S.A. (arboriculture) degree, a student's transcript list of courses readily identifies his familiarity with arboricultural oriented class and laboratory work. Thus the person's academic record becomes a vehicle for employment recognized by those agencies and organizations requiring (an increasing trend) a minimum prerequisite of a university degree. If an individual is inclined to pursue graduate studies and specialization in some aspect of ar-

boricultural research the four-year programme is an absolute necessity. Current personnel management practices attendant to advancement to middle-management positions in larger arboricultural firms or organizations favor those individuals with broad-based collegiate training that includes socio-economic oriented course work. The fourth advantage is financial for the university graduate usually has a greater wage-earning capacity and potential than the non-grad.

To further the educational goals of ISA's Arboricultural Research and Education Academy and ISA's Urban Forestry Committee it is suggested that we continue our cooperative programs with the Urban Forestry Working Groups of the Society of American Foresters and the Canadian Institute of Forestry. All four units are directly concerned with the promotion of innovative teaching and research methodologies to enhance urbanizing vegetation management systems, so close coordination is essential.

In an endeavour to advance comprehensive coordination, Andresen offers the services of the University of Toronto's new Centre for Urban Forestry Studies. As one of its functions the Centre could serve as a focal point for dissemination of information to arboricultural educators, interested students, and inquiring employers.

Conclusion

If arboriculture is to retain its effectiveness as a socially oriented service (its practitioners are committed to manage trees for man's immediate and anticipated use), it must respond to contemporary issues and be ready to adapt to the myriad challenges that accompany today's and tomorrow's urban evolution. However, university grads, by virtue of their education alone, have no monopoly as contributors to the arboricultural profession. Those with complementary skills and training are just as vital. We must use the native and refined talents of all those individuals included to an arboricultural career. By incorporating the experiences and education of arborists at all levels and by creating a smoothly functioning team we will be of optimum support to our and the future world.

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ABSTRACT

Odoi, N. 1976. **Index of plant sensitivity to air pollution**. *Grounds Maintenance* 11(2): 68, 70, 72, 74-76.

Pollution injury is difficult to diagnose and is often confused with other causal factors, ranging from nutrient deficiencies to soil moisture extremes or even simple aging. This is especially true of chronic injury which takes place almost imperceptibly over a period of several years. Even if the pollution dose is not lethal, it may interfere with the plant's physiological processes causing growth rate decline, premature leaf drop or an increased vulnerability to disease and pests. Pollution is not clearly implicated as a cause, but plant and financial losses result. To diagnose pollution injury, first rule out other possible causes of damage. Consider the probability of pollution as a cause in terms of distance from source, weather conditions, wind, etc. Pollutants are not as highly specific as most pests and diseases, so a variety of plants should be affected. Patterns of injury may be apparent. Since pollutants enter the plant through the stomata of the leaves, the main symptoms can be seen on the leaf surface. Damage is most common in late spring and early summer when the leaves have not yet matured and are still quite sensitive.