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Bulletin No. 28: The Connecticut Arboretum: Its First Fifty Years 1931 - 1981

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THE CONNECTICUT ARBORETUM

Its First Fifty Years

1931-1981



THE CONNECTICUT ARBORETUM
CONNECTICUT COLLEGE

BULLETIN No. 28
NEW LONDON, CONNECTICUT



The Connecticut Arboretum 50th Anniversary, June 6, 1981. Top row, left to right: Dr. Richard Jaynes of the Connecticut Agricultural Experiment Station, guest speaker; Karen McGlathery '81; John C. Cook, Director of the Thames Science Center and R. Francis Johnson, Dean of the Faculty, Connecticut College; Randall J. Ameele, Assistant Professor of Botany. Middle row: Barbara R. Kashanski '54 and Martha Capizzano; Rose Fishman, Secretary to the Botany Department; luncheon on the Buck Lodge porch; Virginia Avery (right), wife of the first Director of the Arboretum. Bottom row: Betty Pinson, and Yolanda Pereira, Assistant in Botany; R. Scott Warren, Professor of Botany and Chairman of The Department at Connecticut College, Philip P. Youngholm, Music Librarian, Sarah Freeman, Dr. George S. Avery, first Director of the Arboretum, Richard Birdsall, Professor of History at Connecticut College and Esther B. Goodwin, wife of the second Director of the Arboretum; George Egeland, Sally L. Taylor, Associate Professor, Botany at Connecticut College, and Dorothy Richardson, Professor Emeritus of Zoology; Dr. Peter Ashton, Director of the Arnold Arboretum. Photos by Jo-Ann Dery, Karen J. McGlathery and Randall J. Ameele.

Front Cover: *The original white pine by the Outdoor Theatre blew down in 1938. It was subsequently replaced.*

THE CONNECTICUT ARBORETUM

ITS FIRST FIFTY YEARS

BASED ON PAPERS PRESENTED AT
THE 50TH ANNIVERSARY CELEBRATION
AT CONNECTICUT COLLEGE
JUNE 6, 1981

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THE CONNECTICUT ARBORETUM

Bulletin No. 28

October, 1982



The three Directors of the Connecticut Arboretum at the 50th Anniversary celebration, June 6, 1981: George S. Avery (right), 1931-44; Richard H. Goodwin (left), 1944-65, 68-69; William A. Niering (center) 1965-68, 1969-present.

Dr. Avery received his training at Tulane, Dartmouth and the University of Wisconsin. He was on the faculty of Duke University for four years before coming to Connecticut College as Professor of Botany and Chairman of the Department. His special research interests were in the fields of plant morphogenesis and growth regulators. Under his direction the laboratory at Connecticut College became known internationally for its early contributions to the knowledge of plant hormones. He relinquished his post at Connecticut to become Director of the Brooklyn Botanic Garden, where he spent the remainder of his distinguished career.

Dr. Goodwin was educated at Harvard University, where he took his doctorate under Professors Ralph H. Wetmore and Kenneth V. Thimann. After a post-doctoral year at the University of Copenhagen he joined the faculty of the University of Rochester, where he taught for six years before coming to Connecticut College as Professor of Botany and Chairman of the Department. His research contributions have been in the fields of cytogenetics and morphogenesis. At Connecticut College he conducted studies on the growth of roots that were supported with grants from the National Institutes of Health. He has been very active in conservation, especially since 1958 when he first became President of The Nature Conservancy.

Dr. Niering's undergraduate training at Pennsylvania State University was interrupted by military service in the Pacific Theatre during World War II. He received his doctorate in plant ecology at Rutgers University under Professor Murray F. Buell and joined the Connecticut College faculty in 1952. Since then, with the exception of a year at the National Science Foundation as Associate Director of its Environmental Biology Program, he has been at the College. His special research interests in the field of vegetation dynamics have led him to investigations in Arizona, the Central Pacific, Australia and New Zealand.

Early Historical Highlights

George S. Avery

Last spring Bill Niering invited me to join in the symposium celebrating the 50th anniversary of the Arboretum. As the Arboretum's first "chief" and still alive how could I refuse? But before carrying out my assignment, let me tell you briefly how I happened to come to the College.

My first professional appointment after graduate school at the University of Wisconsin took me to Duke University, where I had several happy years before taking a year's leave of absence on a National Research Council Fellowship. This took me to Columbia University for a year with Professor Edmund Sinnott in the autumn of 1930. It was while at Columbia that I had an invitation from Connecticut College's new President, Katharine Blunt, to visit the College. The upshot of three trips was the offer of a professorship in Botany with the added responsibility of starting the Arboretum on some 64 acres of College-owned land. I must confess that it was flattering to be challenged by an opportunity, at the not-so-ripe age of 27, of founding an Arboretum. My wife of 4 short years had roots in Connecticut, so you can imagine that there was more than a flicker of interest.

It was on the second visit that President Blunt, as I recall the incident of some fifty years ago, rolled out a huge blueprint of the "ground-plan" of the Proposed Arboretum. It had been prepared by one of New York's highly respected Landscape Architects, Mr. A. F. Brinckerhoff. The plan featured and helped to dramatize the already existing grove of ancient hemlocks that grew atop the forty-foot granite cliff on the far western border of the property, now part of the Bolleswood Natural Area. The trees dated well back into early colonial times. As I think back over the half century, it seems that the hemlock grove had a special message for me—a true nostalgic appeal. It had been given to the College at the time of its founding, in 1911, by New London Poetess Anna Hempstead Branch. It was through her family that the land had been handed down through six generations.

The prospect of leaving Duke University to come to a small New England college brought a sharp tease and rebuke from the head of my department at Duke. "You mean you have decided to leave Duke for a small *woman's* college in New England?" The die was cast. And at the end of the NRC Fellowship year in New York, we came to New London, with our two young children. Our household effects were shipped by truck from North Carlina, and met us at 31 Addison Street in late August. We lived there for the next 3 years, then moved to 443 Eastern Point Road in Groton, where the college had recently been bequeathed a pre-revolutionary house that had been owned since before the American Revolution by an unrelated branch of the Avery family. So much for the personal story and our link to the College, a most happy association of 13 beautiful years.

What was the site of the Arboretum-to-be, as I found it? Except for the magnificent stand of hemlocks, the 64-acre site of woodland and one-time farm land offered only natural vegetation of limited interest. As a piece of Mother Earth, however, it excelled—dramatic granite outcrops here and there, granite boulders, and stone walls built by the Bolles forebears. Its interesting topography of rolling hills and little valleys offered a perfect site for the Arboretum-to-be. The only man-made scar was a stark concrete dam that created a small open pond and swampy area filled with dead brush and a few dead trees, which had succumbed to



The Laurel Walk flanked by red cedar. Above: Taken about 1936. Below: The same scene 20 years later.



seasonal flooding by water backed up behind the dam. Mr. Brinckerhoff had sensed the possibilities, however, and the pond in a very few years was to become an important feature in the landscape.

Step one: In the autumn of 1931, the Connecticut Daughters of the American Revolution ("DAR") were making plans and seeking opportunities for appropriately celebrating the bicentennial of the birth of the nation's first president. The attention of their State Committee was directed, through friends, to the College, and to the possibility of their giving a more-or-less formal entrance to the Arboretum-to-be. Miss Katharine Matthies of Seymour, Connecticut, and her colleague, Miss Nettleton, were members of the DAR Committee that visited the College. I well remember their inspection of the potential site for the Arboretum entrance, the barren hillside on Williams Street opposite the entrance gate to the College campus. After the inspection President Blunt entertained them at lunch-

eon in her home. The impression on the visiting committee must have been a good one, for a report came from the DAR not long afterward. The project was approved! We learned later that Miss Matthies and her mother were the behind-the-scenes donors. Detailed working drawings and specifications were prepared by the Brinckerhoff firm and construction was completed in 1932, in time for an appropriate dedication ceremony.

Step two consisted of refining the pond. The dead brush and trees were hardly an appropriate terminus for the stately new *Washington Entrance* of the Arboretum-to-be and the handsome laurel walk. As the Roosevelt Administration got underway in 1932 to fight the depression in that sad period of our country's history, one of its programs was to create jobs through its newly organized Works Progress Administration, known as the "WPA". The New London WPA management assigned a number of men to the College for work relief jobs—jobs created where there were none before. The Arboretum benefitted enormously from this program. One of the first projects was to improve the pond. To include an historical touch . . . the dam and the pond had originally been the idea of Allen B. Lambdin, Business Manager of the College for many years. Its reason-for-being was to provide a place for students to ice-skate in winter months. Mostly mild winters, with little or no ice, led to the project being known as "Lambdin's Folly." Little did his critics appreciate the pond's potential. Anyway, the WPA workers came en masse. The pond was drained and they went in with axe-and-saw to clear it out. A few stumps and large boulders remain to this day. A rainy autumn filled the pond and it came to be more respectably known as the Lake in the Arboretum. The red pine trees on one side of the lake were planted in 1928 by the local chapter of the Isaac Walton League. They were only a foot or so in height in 1932.

One of the WPA workers had an old more-or-less broken down truck that he rented to the project for \$5.00 per day. Soil was hauled from I don't remember where to build up the shore of the Lake wherever the ground was previously low and wet, thus making a delightful all-year trail around the Lake. A modest peninsula was also built out into the water on the east shore—another of the soil-trucking projects, and the stark concrete dam was covered, to obscure it.

Step three was the construction of the Outdoor Theatre and the Lodge. Shortly before College Commencement in 1932, President Blunt telephoned to say that one of the graduates-to-be, Miss Frances Buck (Mrs. John W. Taylor) of Chicago, had been in to report that her parents were giving her a graduation present of \$2,000, a reward for making good her pledge not to smoke as a student. She wanted to give this sum to the College. "What would we think of giving it to the Arboretum?" Miss Buck liked the idea of an Outdoor Theatre, so Mr. Brinckerhoff was again commissioned to come up with detailed plans. The theatre, situated at the north end of the Lake is now a familiar part of the Arboretum landscape. The Buck family was so pleased with the Theatre, which for several decades was the scene of Class Day Exercises at College Commencement, that Mr. Buck later gave a fund for the construction of a stone field house, now familiarly known as Buck Lodge, situated near the Outdoor Theatre.

While the Lodge was under construction, largely by WPA-paid stone masons, a friend of the construction supervisor came one day to pay him a visit. A part of the conversation which I chanced to overhear went something like this: "What are you building here, Jim?" Answer: "We're building a lodge." The visitor, after looking at the two-foot thick walls under construction: "Heck, Jim, you're not building a lodge, you're building a fort!" The Lodge apparently continues to be a popular meeting place for student groups and others in the mild-weather seasons of the year. From its high veranda, one looks out into the woods and at the Lake.



Class Day Exercises in the Outdoor Theatre, 1958.

The Arboretum Association. The development of the physical facilities that brought the Arboretum into the life of the College did not “just happen.” It seemed important that the institution become more than simply the College Arboretum. Early on came the idea that it should be the *Connecticut Arboretum at Connecticut College*. To help give it a broader appeal and, hopefully, to bring state-wide interest and wider support, a membership organization was formed in 1932—The Connecticut Arboretum Association. Miss Katharine Matthies became its first secretary. For several years the annual income from members—Garden Clubs and individuals—amounted to somewhat less than \$500. The College budgeted \$1,500, so for most of those early years a total of \$2,000 was our operating budget. Fortunately, this did not have to pay salaries of personnel! The College Botany teaching staff was “carrying the ball.”

Step four, the plant collection. Income from the Arboretum Association was devoted chiefly to building up the plant collection. A nursery was started and assembling plants native to Connecticut became the chief objective. In two or three growing seasons the plant collection in the nursery had grown to more than 200 species. Dr. C. B. Graves' Herbarium was giving us helpful guidance on what to seek. As the young trees and shrubs attained transplanting size, there was a special planting day each spring in which student volunteers, chiefly botany majors, were involved. Sections of the Arboretum were designated for certain plant families, according to the Brinckerhoff Plan. Other areas were left “in the wild” or were planted with red pines, the latter perhaps an unfortunate decision, as there is now a threatening disease of this species. It should be mentioned that hundreds of extra plants, well beyond Arboretum needs, were grown in the nursery to give to Arboretum Association Members for planting in their own communities across the State.

An Arboretum tragedy. The September 21st hurricane of 1938 brought disaster to the grove of 130 ancient hemlocks. Only 18 trees remained standing after the storm and 12 more died in the summer of 1938, probably from the effects of the salt spray which swept in from Long Island Sound. Dr. Niering reports that as of 1981, only a very few of the original giants still survive. They are now probably



A view of the Bolleswood hemlock grove on the crest of the ledges before and immediately after the 1938 hurricane.

well into their third century. Shortly after the disaster a botanical study of the fallen trees' took several months of "spare time" effort, and involved my colleagues in the Botany Department, as well as advanced students.

Let me digress for a few moments to tell you of activities of the Botany Department. Students taking Botany courses were our main concern. Good teaching had the highest priority; the Arboretum was a non-academic arm of the Department that was to grow in importance with the years. It would supplement the teaching program. Meanwhile, classroom activities and scientific research had the closest attention. Drs. Paul Burkholder and Harriet Creighton were my senior colleagues who helped so importantly in scientific research as well as carrying their full share of the teaching load. Dr. C. B. Graves' herbarium of the native plants of

this region was a most helpful gem. The Rockefeller Foundation made a grant toward the construction of greenhouses and air-conditioned laboratories in the basement beneath them. As plant hormone research got underway, the Dow Chemical Company for several years provided the salary of a research assistant. Students became involved, to the extent that it was possible, in all departmental activities. Miss Priscilla Pasco, for example, of the Class of 1939, collaborated with Dr. Creighton in publishing *A Plant Handbook: Lists of Plants for Specific Landscape Uses*, published as *Arboretum Bulletin No. 3*.² It was popularly received and, in a limited sense, was a best seller. Many publications in scientific journals came from the joint efforts of the Avery, Burkholder and Creighton team, with a number of loyal and hardworking assistants to help along the way. It should be mentioned that Miss Katharine Matthies furnished and equipped the botanical laboratories. These were model installations for their time. A Senior Fellowship granted by the Rockefeller Foundation made it possible for me to have a leave of absence for research in Denmark at the University of Copenhagen and the Carlsberg Laboratory. This seven-month stint in 1938 researching in Copenhagen and visiting European laboratories furthered our departmental scientific efforts in plant hormone-related problems, and I returned to Carlsberg again the summer of 1939.

But to go back to the story of the fallen hemlocks, after the 1938 hurricane had left its mark on the Arboretum. Although the Botany staff was so actively involved in plant hormone research, it seemed important to take time off for tree ring studies to establish the age of the trees and whatever else we could find out about them. The trees studied ranged from 106 to 171 years of age. The majority had grown on the dry rocky ledge, while a few others had been favored by the moist soil of the ravine along the brook. Although the width of the annual rings was consistently greater in the trees growing in the moist soil, the trend from year to year was the same for the trees in both habitats.

In the College Library there is an original receipt for payment made by Thomas Bolles to the Mohegan Sachem, Owaneco, the son of Uncas for a tract of land in the general area now owned by the College. It is dated October 14, 1693, and is on permanent loan from the New England Historical Genealogical Society. Thus, the oldest trees studied on the rocky ledge did not have their start until 74 years after the Mohegans sold their land to their white successors for "4 yards of duffels." A reproduction of the Owaneco receipt appears in *Arboretum Bulletin No. 2*.

Except for the acquisition of two parcels of land, one of about 15 acres in 1936, and another of 10 acres in 1942, this is the story of the Arboretum's beginnings. In the 1936 deed for the 15 acres, all the donors signed. Afterward, a lawyer and contributor remarked that if one of the donors had died during the weeks that the deed was going back and forth in the mails, the whole gift-process might have been in legal trouble for quite a time. Fortunately, everyone lived!

A closing anecdote: In the earlier years of the Arboretum, a farmer on Bloomingdale Road kept a few cows. His land and pasture bordered the Arboretum on the west. Occasionally one or two of his cows would stray into the Arboretum, whether for possible cultural enrichment, or simply better pasture, we could never be sure. On one occasion a cow got as far as the Outdoor Theatre and lower end of the DAR Entrance Walk—The Washington Entrance! Telephone calls always brought the owner to rescue his cows; but once, when the ground was soft after a rain, deep hoof marks were left in the lawns. The cow was impounded and the farmer had to pay a few dollars toward the cost of repairing the damage. That was the last of the bovine visits. The Arboretum has always welcomed people.

The Connecticut Arboretum Its Establishment and Growth

Richard H. Goodwin

The present account of the establishment and growth of the Connecticut Arboretum is part of a more ambitious history of the land upon which Connecticut College and the Connecticut Arboretum are situated. The story is an outgrowth of research on the natural history of the area, to be described later by Dr. Niering, of archaeological digs, and of a study of the land records and other documents going back into Colonial times. Preliminary accounts of some of these findings have already been published.¹ It is hoped soon to gather all of this information into a book.

Establishment and Early Years

At the time Connecticut College for Women was founded in 1911, land acquisitions for its site in New London included the John R. Bolles farm, most of which was purchased from Mr. Bolles' daughter, Mrs. Mary Lydia Bolles Branch. Thirty-eight acres of this farm, which lay to the west of Williams Street and south of Gallows Lane, were to become the nucleus of the present Arboretum. This land had been in the possession of the Bolles' family since the original division of the Inner Commons in 1733. The ledgy westernmost sixteen acres extended into the Town of Waterford and were the site of a handsome grove of hemlocks, which had flourished under the stewardship of the Bolles' family (tract 2, map inside back cover). This piece was given to the College in 1911 by Mr. Bolles' granddaughter, the poetess, Anna Hempstead Branch, who stipulated in the deed that the tract should be "a park for the use and engagement of said college and their friends" and that it should be named Bolleswood in honor of her grandfather.⁴ This woodland had been a favorite picnic spot for people in the community and was soon frequented by the students and faculty after the College opened its doors in 1915. Bolleswood became the site of student pageants. The participants in the 1919 production are shown standing on the crest of the ledges in Indian costumes in the photograph reproduced on pages 10 and 11.

By 1926 the College had managed to negotiate the acquisition of an additional twenty-six acres of farmland contiguous to and south of the Bolles property (tracts 3a and 3b). A plantation of red pines was established on this tract in 1928 under the direction of Arthur W. Graves, Professor of Botany, and the same year the business manager of the College, Allen B. Lambdin, had a swampy woodland cleared and a dam constructed to form what is now known as the Arboretum Lake, as has been mentioned by Dr. Avery.

Thus it came to pass that the resources necessary for the establishment of an arboretum were at hand—about 64 acres of undeveloped land across the street from the entrance to the campus, a magnificent hemlock grove legally restricted to use as a park, a lake, a pine plantation, and a diversity of natural habitats, including bogs, red maple swamps, ledges, rocky woodlands, and open fields. But it was not enough that the head of the Botany Department, Professor Caroline Black, should have a cherished dream of such a development. In the late 1920's she had been developing a small botanical garden on the east side of the campus, which has flourished in the half-century since her death and has been named in her



The Class of 1924 presents its Freshman Pageant in the Bolleswoods. Photograph given to the Botany Dept. by Gloria Hollister Anable second from the right. College Archives, Connecticut College Library.

honor. To the west, the Administration's plans called for a division of all the College owned frontage along Williams Street into house lots. The first and southernmost of these was, indeed, laid out and subsequently sold in 1933 to Professor Carola L. Ernst, Chairman of the French Department, who built a home on the property. This house, after passing through two other ownerships in the next 36 years, was finally purchased by the College and has now been converted into the President's residence.

It was Mrs. Charles A. Cutler of Westport who suggested the Arboretum concept to President Katharine Blunt, when she visited the College early in 1931 in conjunction with a Garden Club meeting. Happily, the idea commended itself to the President, who was in the process of seeking a new head for the Botany Department. Among other benefits, she saw the potential of this project for attracting an outstanding candidate to the faculty. Being a woman of action, she promptly obtained the approval of the College Trustees for the establishment of an arboretum and retained Mr. A. F. Brinckerhoff, President of the New York Association of Landscape Architects, to draw up a plan for an arboretum west of Williams Street.

On April 30, 1931, Mr. Brinckerhoff submitted a map and general description of the project. The Brinckerhoff plan, characterized as a vigorous, masculine conception, called for an entrance court on Williams Street opposite the gate to the campus, steps and ramp leading down to an overlook plaza near the lake, an outdoor amphitheatre large enough to accommodate an audience of a thousand persons, arboretum plantings of trees and shrubs, arranged according to their family relationships, and a system of trails around the lake and through the beautiful Bolleswood hemlocks.

In the fall of 1931, Dr. George S. Avery, Jr., joined the Connecticut College faculty as Professor, Chairman of the Department of Botany and Acting Director of the newly-established Arboretum. The following spring, he was appointed Director, a position which he filled for the next twelve years with great energy and imagination.

The story of the growth of the Connecticut Arboretum differs significantly from that of most other horticultural institutions in this country. It had no single wealthy patron; and its sponsor, Connecticut College, had no financial resources



to invest in its development. The success of the venture, therefore, hinged on the Director's ability to draw support from outside sources.

At the outset, an Advisory Committee was formed, composed of representatives from the College Board of Trustees, the administration, the Federated Garden Clubs of Connecticut, the New London Garden Club, and other interested and influential individuals. Among these were the State Forester, Mr. Austin F. Hawes, and the noted ecologist from Yale University, Professor George E. Nichols. Shortly thereafter, the Connecticut Arboretum Association was established, whose membership consisted of individuals and institutions contributing to the enterprise.

Great enthusiasm was aroused among members of the Board of the Federated Garden Clubs and of the Connecticut Daughters of the American Revolution. By 1932, the latter organization under the instigation of Miss Katharine Matthies had committed \$2,000 to the construction of the first feature of the Brinckerhoff plan, the Washington Entrance, so named to commemorate the 200th anniversary of the birth of the nation's first president. Most of the labor for this project, and also for the plaza overlooking the Lake, the interconnecting ramp—later to become known as the laurel walk, burial of the cement dam that forms the Lake, and some of the other paths, was provided by the New London Unemployment Relief Committee, which was responsible locally for administering the federal relief program. The value of this contribution was estimated to be \$21,000.

The Connecticut Arboretum was dedicated on October 6, 1934. Its purpose, as stated by President Blunt, was "the preservation and propagation of the native plant life of Connecticut, and the scientific arrangement of that plant life for purposes of study." It was this emphasis on the native flora that distinguished the enterprise from other horticultural institutions.

Much effort was directed during these early years toward developing the plant collections. Gifts of specimens were received from nurseries and individuals, native perennials came from Yale University's Marsh Botanic Garden, and species were collected from the wild. The Director was ably assisted in this work by an amateur botanist, Kaleb P. Jansson, who came to this country from Sweden where he received his early training. Most of this plant material was propagated and set out in nurseries. By 1935, nearly 5,000 specimens, representing 258 species, were under cultivation in the nurseries. Three years later the number had doubled. A special transplanting fund was raised in 1938 to help move some of this nursery

stock into permanent positions.

In 1934, a gift was received from Mrs. Frances Buck Taylor, Class of '32, and her mother, Mrs. Nelson L. Buck, for the construction of the Outdoor Theatre, the last major feature required to complete the Brinckerhoff plan. Finished the following year, it was so located as to preserve a majestic white pine that had earlier become the emblem of the Arboretum (see front cover).

In 1937, another gift was received from the Buck family, this time for a rustic stone lodge with large fireplace and a porch overlooking the Lake. This facility, known as Buck Lodge, has ever since been in constant use for meetings and recreational gatherings; its basement has been an indispensable repository for Arboretum equipment. Later gifts from the Bucks made it possible to bring electric power to this building and to endow its maintenance.

On September 21, 1938, the great hurricane struck southern New England. This natural catastrophe took its heavy toll in the Arboretum, especially in the Bolleswood, where 112 large trees were destroyed, including most of the old hemlocks. The big pine by the Outdoor Theatre went, as did a great oak that shaded the porch of Buck Lodge. Clearing away the debris and repairing the damage created by this storm occupied the energy and resources of the staff for the next three years; and then World War II siphoned off the manpower, reducing the Arboretum's program to a skeleton operation until 1945. A special \$200 gift from Mr. Buck made it possible to replace the big pine beside the Theatre with a smaller tree, which has now reached imposing dimensions.



Buck Lodge with ski slide to the left, skiers in background. Taken about 1940.

Growth of the Arboretum

Of great significance to the Arboretum and to Connecticut College has been the gradual growth of the real estate holdings. Initiated during Dr. Avery's directorship, the land acquisition program was carried on vigorously by his successor, Dr. Richard H. Goodwin, who assumed his duties in the fall of 1944. It has been a fortunate circumstance for the Arboretum that the two changes that have taken place in its directorship have occasioned minimal discontinuity in the progress of the institution's development.

The following account describes how the Arboretum has increased in size from its original 64 acres to 415 in the thirty-nine years from 1936 to 1975, and how other College holdings to the north of the campus have been increased by an additional 111 acres.

For convenience, the twenty-eight additions have been arranged into three groups according to their locations—the first immediately contiguous to the original Arboretum, the second north and northeast of the campus between Williams Street and the Thames River, and the third north of Gallows Lane and west of Williams Street. Tracts are listed in order of acquisition in Table 1, and are shown on the map inside back cover. The many individuals and organizations whose contributions have made all these acquisitions possible are listed on pages 52 to 55.

Table 1. Data on Arboretum Tracts

Key to abbreviations:

Buildings:	Method of Acquisition:	Other Uses:
B = Barn	CP = College Purchase	FH = Faculty House
H = House	G = Gift from grantor	HL = House Lot
HG = House and Garage	GP = Purchased with gifts	MW = Municipal Watertank
S = Shed	or by gifts in the	OS = Open Space
	proportion indicated	RP = Riding Program
		SB = Storage Building
		SWS = State Wildlife Sanctuary
		TSC = Thames Science Center
		WLL = Waterford Little League ballfield

No.	Name of Tract	Year Acq.	Acreage and Buildings	Method of Acq.	Amount of Gift	Total Cost or Value	Arboretum Acres	Other Uses
1	Branch	1911	21.6	CP	—	(1)	21.6	
2	Bolleswood	1911	16.5	G	(2)	(2)	16.5	
3a	Comstock	1926	3.8	CP	—	\$ 9,900	3.4	HL
3b	Comstock	1927	21.8	G	(2)	(2)	21.8	
4	Ravine	1937	15.7	GP	\$ 3,232	3,232	15.7	
5	Benham Avenue Ext.	1942	10.3	GP	3,500	3,500	10.3	
6	George S. Avery	1944	33.2	65% GP	3,247	5,002	33.2	
7	Katharine Matthies	1946	26	GP	12,000	12,000	26	WLL
8	Gallows Lane Ext.	1946	19	24% GP	927	4,056	19	TSC
9	Frances S. Williams	1950	19 B	39% GP	3,012	7,658	18	RP, SB
9a	Faraci House & Lot	1972	0.7 H	CP	—	6,500	0.1	FH
10	Monroe	1950	15.7	GP	1,658	1,658	15.7	
10a	Monroe House & Lot	1956	1.3 H,S	35% GP	3,000	8,500	1.0	FH
11	Ribaud	1951	29.2	90% GP	4,500	5,000	29.2	
12	Hempstead	1952	5	GP	500	500	5	
13	Mamacoke Island	1955	40.5	GP	15,000	15,000	40.5	
14	Richard Hale Goodwin	1956	8	GP	2,250	2,250	8	
15	Kip House & Lot	1958	0.7 HG	CP	—	12,500	—	FH
16	Brailsford	1958	28	CP	—	10,000	—	OS
16a	Lot No. 16	1968	0.7 H	CP	—	31,500	—	FH
17	Burdick	1959	1.5	CP	—	600	1.5	
18	Hirschfeld	1959	24	CP	—	5,000	24	
19	Coffey Farm	1959	50 H	CP	—	67,500	4	FH, OS
20	Hirschfeld Farm	1960	50	42% GP	2,500	6,000	49	MW
21	Espinosa House & Lot	1963	3 HG	15% GP	4,000	26,250	2	FH
22	Lloyd B. Benham	1964	0.2	G	(2)	(2)	0.2	
23	Thames Science Center	1968	4	G	2,000*	2,000*	4	
24	Goodwin	1969	20.5	G	12,300*	12,300*	20.5	
25	Lodus Realty	1970	32	CP	—	45,000	—	OS
26	Wuerdemann	1975	24	GP	16,400	16,400	24	
27	Worcester Lot	1976	0.2	50% GP	750	1,500	—	OS
A	State Wildlife Sanctuary	1957	8.9	GP#	1,800	1,800#	—	SWS
B	West Farms Land Trust	1975	5.5	GP+	2,500	2,500+	—	OS

* Value determined by appraisal.

Gift to the State of Connecticut.

+ Conservation restriction purchased by the West Farms Land Trust.

- (1) The price for a total of 54.6 acres, including buildings east of Williams Street, was \$37,500.
- (2) The value of gift not determined but may be partly reflected in the cost of the adjoining property acquired from the same family.

South of Gallows Lane.—The Ravine (Tract 4), a narrow north-south defile lying between the vertical Bolleswood ledges and a rocky ridge to the west, is traversed by a small, intermittent stream fed by a watershed and wetlands to the north of Gallows Lane. Most of this sixteen-acre tract had been too rocky and steep ever to serve as crop land, but at least the northern portion had been cleared and used as pasture until as recently as the early part of this century. The open nature of this area is shown in the photograph reproduced on pages 10 and 11.

One day in 1936 a founder of the College and for many years its Bursar, Miss Elizabeth Wright, was walking along the crest of the Bolleswood ledges. She discovered a couple of workmen about to drill the foot of the ledge preparatory to blasting. Some of the original College buildings were built of stone quarried from outcrops now within the Arboretum boundaries, and this would have been an extension of the operation. Miss Wright leaned over the ledge and in her deep, authoritative voice requested the men to suspend their activities until the matter could be investigated by the College authorities. Thus was generated an immediate concern for the preservation of the ravine as a feature of natural beauty to be added to the Arboretum.



Ledge in the Bolleswood Natural Area. 1972.

Dr. Avery solicited contributions from friends of the Arboretum, and the tract was purchased from the owners, Lucien and Sebastian Ribaud, for \$3,233 in the names of the forty donors (36 individuals and four organizations). On March 22, 1937, it was quit-claimed to the College and thus, the signatures of all the donors appear on the deed. This was the first of a long series of additions to the Arboretum.

Fourteen years later, the remainder of the farmland lying to the west of the Ravine Tract, with the exception of the frontage along Bloomingdale Road, was acquired from the Ribaud family. Responding to another fund drive organized by Dr. Goodwin, 35 individuals and four organizations contributed \$4,500—ninety percent of the purchase price—so that this land (*Tract 11*) might also be added to the Arboretum. The largest single donation for this purchase was one of \$1,000 received from the American Tree Association.

The block of land lying west of Williams Street, south of Gallows Lane and north of the high-tension line bringing power to New London has now been enclosed with eight-foot chainlink fencing on three sides and wrought iron on the Williams Street frontage. This project, started in 1948, was finally completed in 1973 at a total cost of \$59,611. Ninety percent of the cost of this installation was defrayed by gifts to the Arboretum. In 1952, the fenced section west of the lake was set aside by action of the College Board of Trustees as the southern unit of the Bolleswood Natural Area, to be maintained as nearly as possible in an undisturbed state.

At the south end of the ravine the valley opens out into a small forested wetland threaded by the stream. This land lies at the northern end of a tract acquired during World War II by the Federal Government for a housing project. When in 1955 it became known that the Government was to dispose of this property, an attempt was made to secure title to the undeveloped portion as an educational grant to the College. The request was rejected on the grounds that no buildings were to be constructed. Two years later, the state purchased 8.9 acres (*Tract A*) for a wildlife sanctuary with \$1,800 donated for the purpose by a foundation. Subsequently, the City of New London tried to acquire the property from the state through an act of the Legislature, the purpose being to get it into private hands so that it might provide tax revenue to the City. Since the deed requires that the State shall hold these premises "... for public use and no other purpose, forever,"⁵ the bill was ruled illegal by the Attorney General. The State Board of Fisheries and Game, later to be consolidated into the Department of Environmental Protection, was given jurisdiction over the property. It has asked the Arboretum to manage this Wildlife Sanctuary, which is providing vital protection to the southern edge of the Bolleswood Natural Area. The flora of this area has been inventoried.⁶

East of Williams Street.—In 1942, a twenty-seven-acre portion of the Fitzgerald Estate, lying immediately north of the College campus between Williams Street and Mohegan Avenue, became available for \$10,000. At that time, owing partly to troublesome uncertainties generated by the second World War, the College administration was unwilling to divert any of the College's resources toward the acquisition of additional real estate. For a second time Dr. Avery rallied the support of two garden clubs and 32 friends of the Arboretum, raising \$3,500—a sum sufficient to purchase the southern third of this property, now known as the *Benham Avenue Extension (Tract 5)*. The donors, desirous of preserving the College's rural setting, bought the property as a group and subsequently conveyed it to the College with stringent legal restrictions as an addition to

the Arboretum. Wording in the deed of gift admirably expresses the philosophy motivating the whole land acquisition program which was then beginning to unfold. The purpose was "to insure that the . . . College . . . will not in the future find itself completely surrounded by land which is extensively devoted to residential and commercial uses, thus depriving the . . . College . . . of the advantages which accrue to such an institution from open fields, woods, and hills adjacent to it." Had it not been for the foresight and generosity of the many friends of the Arboretum, this is exactly what would have happened. As an example, the remaining 17 acres of this portion of the Fitzgerald Estate to the north were immediately purchased by private individuals and have since undergone residential development.

The Benham Avenue Extension at the time of acquisition was an abandoned field being invaded by catbrier, black cherry, and red maple. Between 1945 and 1946, about two-thirds of the lot was planted to white pine, hemlock, and a few European larch. Today much of this tract is a forest plantation; but an experimental plot has been established within the natural greenbrier thickets in order to study the stability of this type of shrub community.

At the time the College acquired the Benham Avenue Extension, Dr. Avery and some of his students prepared a map of the College holdings and those of adjoining landowners, thus identifying additional opportunities to preserve the environment of the College. On the basis of this information, a program for future action was recommended.

When Dr. Avery resigned his position at the College to assume the Directorship of the Brooklyn Botanic Garden in 1944, his colleague, a former student and then an instructor in the Botany Department, Bette Bindloss (later Mrs. Raymond Johnson) negotiated the purchase of a second piece of the Fitzgerald Estate lying between Mohegan Avenue and the Thames River and solicited contributions from Dr. Avery's friends, so that these acres (*Tract 6*) might be named in his honor. Seventeen garden clubs and 106 individuals contributed \$3,247 toward this \$5,000 purchase.

Up to the beginning of this century, the major human impact on the Avery Tract had been agricultural. A photograph taken in 1935 shows the land along Mohegan Avenue as open, but beginning to revert to forest. In another picture in the Arboretum files, dating from the early 1900s, a pasture on the highest ground can be seen sprinkled with cedars. At this vantage point, which commands views of the lower reaches of the Thames River, gun emplacements were constructed during World War II. The steep ledgy terrain sloping down to the Mamacoke saltmarsh is more or less wooded. Here, quite a few large oaks managed to survive the 1938 hurricane, although in a badly damaged condition. On the southern boundary "the cold spring which runs into cove near the old barn"⁸ still bubbles forth as clear drinkable water, feeding a small stream that threads an alder thicket, wet meadow and cattail marsh before emptying into the cove, just as it did in John Rogers' day prior to 1753. The cove is still somewhat under tidal influence through a culvert under the Central Vermont railroad embankment constructed in 1848. The spring was shaded for a couple of centuries by a great red oak that had attained a diameter of 4.3 feet. Rotted at the heart, it fell in 1968. A branch 27 feet up the trunk showed 180 growth rings. Along the steep bank bordering the stream is a beech grove, above which is a small meadow, still maintained by mowing and burning. Here have been found evidences of Indian occupation.⁹ The Indians were still permitted to use this spot by the Rogers family during the first half of the 18th century.

Immediately to the south of the Avery Tract lay the Benham Farm, acquired in

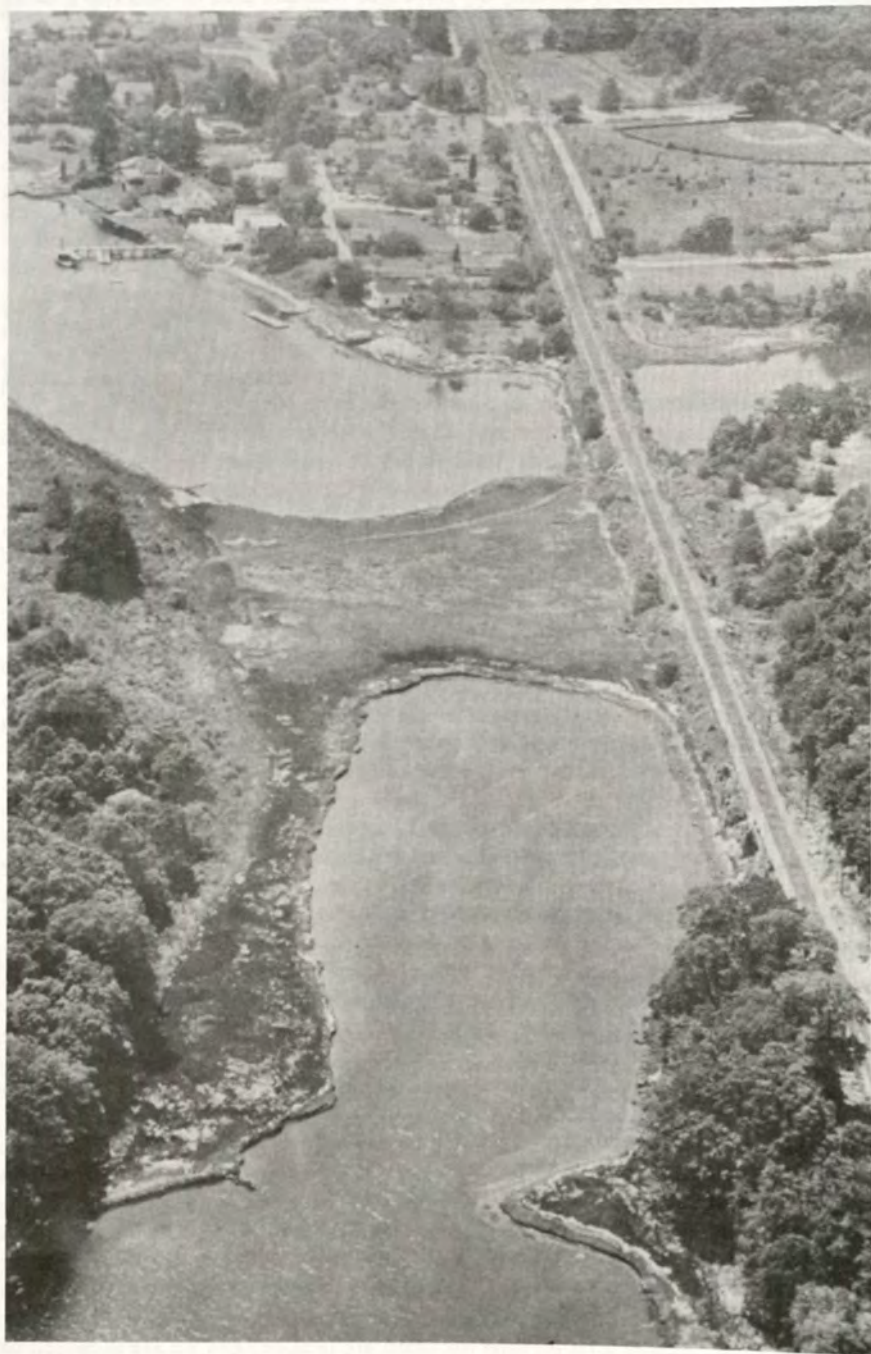
1848 by William Henry Benham, Sr. Here Mr. Benham and his son ran a dairy operation and orchard for seven or eight decades. In 1946 the grandchildren of Mr. Benham were prepared to sell twenty-six acres, including abandoned pastures and orchard on the slope and flat fields below on the river terrace. A telephone call from President Katharine Blunt to Miss Katharine Matthies, one of the Arboretum's staunchest supporters and Secretary of the Arboretum Association, resulted in the gift of \$12,000 that secured this property for the Arboretum. It was named the *Katharine Matthies Tract (Tract 7)* in honor of the donor. Eighteen years later, the two surviving Benham heirs presented the College with a small adjacent lot on Benham Avenue (*Tract 22*) in honor of their brother, Lloyd B. Benham, who was an employee of the College for many years.

Some of the fields and woodlands on the Avery and Matthies Tracts have been used for ecological investigations, funded by the National Science Foundation, on the effects of prescribed burning. A hillside on the Matthies Tract has been naturalistically landscaped by the selective elimination of undesirable trees and shrubs with herbicides, and the flat land has served as a nursery, as experimental plots for testing applications of fungus mycelium from the operations of Pfizer Inc. and as a Little League ballfield until 1980.

Just north of the Avery Tract was a five-acre piece of riverfront property, including a small bit of salt marsh, belonging to Mr. E. Judson Hempstead and his sister, Mrs. Agnes H. Libby (*Tract 12*). This land, now known as the *Hempstead Tract*, was purchased in 1952 by the Arboretum Director for a token \$500 with funds received from sixteen contributors and immediately quit-claimed to the College. The deed legally restricts its use to Arboretum purposes.

East of the Avery Tract a dome of rock known as *Mamacoke Island (Tract 13)* rises 130 feet out of the Thames River. Actually this forty-acre parcel is not an island except during exceptionally high tides; it is connected to the shore by a small patch of unditched salt marsh, noteworthy as having been mowed in 1645, the first year of colonial settlement.¹⁰ An outstanding natural feature in the lower Thames River estuary, "Mamacock," as it was spelled in colonial times, gave its name to the large farm which was acquired in 1658 by James Rogers and which remained in his family for five generations. As a part of the Fitzgerald Estate, Mamacoke came on the market at the same time as the Avery Tract and was purchased by a marine construction company, the Merritt-Chapman and Scott Corporation. Citizens concerned with the development of the State Park System became interested in its acquisition by the state, and this possibility was explored following a meeting of the Connecticut Forest and Park Association held at the Arboretum in the fall of 1947; but the Corporation was uninterested in relinquishing the property at that time. By 1953, however, the Corporation had decided to liquidate its holdings in New London and negotiations were initiated to acquire Mamacoke for the Arboretum. By July, 1954, an option to purchase the land had been signed. Within the eight-month option period, the \$15,000 purchase price and an additional \$1,189 had been raised through contributions from 257 individuals and 29 organizations. The Arboretum Director consummated the transaction as trustee for the donors and subsequently conveyed the property to the College for use as part of the Arboretum.¹¹ The funds raised in excess of expenses formed the nucleus of a small endowment for the maintenance of the tract, which is being administered as the Mamacoke Natural Area.

The terms of the gift written into the deed are unique, and we are indebted to Attorney Belton A. Copp and his associate, Sid M. Miller, for drawing up this interesting document.¹² The natural character of the island and its salt marsh are to be preserved; no roads are to be constructed.



An aerial view of the Mamacoke salt marsh. The former Little League Ballfield and a nursery on the Katharine Matthies Tract show at the upper right. Photographed in 1971 by Jack Urwiller.

A reverter interest held by two organizations, the Connecticut Forest and Park Association and The Nature Conservancy, assures that these conditions will be maintained. In the event that it should become impracticable for the College to administer the property, the two above-mentioned organizations have been named as contingent "trustees." The College must first offer them the opportunity to purchase the tract for a price not to exceed \$500.

The importance of this type of legal protection to the long-range preservation of natural areas held by educational institutions was highlighted by an event that took place two years after the Mamacoke acquisition. Representatives of a company bidding for a government contract to deepen the channel to the U.S. Submarine Base for the atomic submarines offered the College \$50,000—over three times the cost of acquisition of the entire property—for the right to deposit hydraulic spoil on the salt marsh and in the adjacent coves to a depth of 60 feet, thus creating for the College a prime industrial site. The Mamacoke deed happily eliminated the possibility of such a proposition.

The Mamacoke Natural Area has provided the resource base for a number of undergraduate and graduate research projects. The salt marsh in particular has been of especial interest, since it is practically the only one in Connecticut to have escaped mosquito ditching. Its vegetation has been carefully mapped twice, which has permitted an analysis of changes taking place in the zonation of the plant communities.¹³ On the upland an archaeological survey by Dr. Harold Juli and students from the College¹⁴ has revealed evidence of early Indian occupation.

Between the Avery and Matthies Tracts on the south side of the cove was a three-acre lot with house and outbuildings belonging to Michael Espinosa. Here an unsightly dump was growing on the steep bank of the cove. In 1954, negotiations for the acquisition of this property were initiated; but it was not until 1963 that the purchase was consummated. Four friends of the Arboretum and the Connecticut Arboretum Association contributed \$4,000 toward this addition (*Tract 21*) to the College holdings. The house was then renovated for two faculty apartments. A large portion of the dump—about 30 truck loads of rubbish—was removed, and the remainder buried. The wetlands on the property are now being managed as part of the Arboretum.

Thus, in a period of eighteen years, 108 acres of scenic riverfront property, including woodland, ledges, open fields, a fine spring, wet meadow, brackish marsh, salt marshes, and rocky shores, had been added to the Arboretum east of Mohegan Avenue.

North of Gallows Lane.—The first farm north of Gallows Lane on Williams Street became available for purchase in 1945. The late Robert Fulton Logan, professor of art at the College from 1935 to 1954, donated three of his original etchings toward this purchase for the Arboretum. They netted \$523 through the sale of raffle tickets. Four additional contributions brought the fund to \$927. The balance of the purchase price was appropriated by the College, and these nineteen acres were acquired early in 1946 as the *Gallows Lane Extension* of the Arboretum (*Tract 8*).

The house at the corner of Gallows Lane, although part of the farm, was not included in the original purchase. It was in a sad state of disrepair. In 1948, it was bought and renovated by Mrs. Nona Kip, widow of Herbert Z. Kip, professor of German at the College from 1915 to 1935, and was subsequently purchased by the College from her estate (*Tract 15*) for use as a faculty residence. Twenty-eight years later, an undeveloped lot at the very northeastern corner of the original farm with frontage on Williams Street, known as the *Worcester Lot* (*Tract 27*), was bought by the College. Half the purchase price was contributed by Dr. Goodwin.

Judging by the extent to which this farm had reverted to thickets and forest by 1945, agricultural pursuits must have been discontinued around the turn of the century. Most of the eastern half was an impenetrable catbrier thicket; the western half, an oak forest rising abruptly from a wooded wetland to ledges along the western boundary, which borders on Samuel Bolles Road. This western half was added to the Bolleswood Natural Area.

In 1961, an arrangement was made with the Thames Science Center, an organization dedicated to environmental education, whereby the Center's personnel would organize the Arboretum's interpretive programs for the young people in the community. This activity was underwritten for two years by a grant from the Frank Loomis Palmer Fund. At that time, the Center operated out of a small building on Williams Street opposite Deshon House of the Lyman Allyn Museum about a half-mile south of the main entrance to the Arboretum. By 1968, this facility had become inadequate; and the Center obtained a forty-year lease of two acres of the Gallows Lane Extension lying just inside the New London city line on Gallows Lane as a site for its new interpretive headquarters. This arrangement was made in consideration for the simultaneous gift from the Center to the College of four acres of land (*Tract 23*) contiguous to other Arboretum holdings. The new building was completed in 1970 at a cost to the Center of \$150,000. Mr. William Riddle of the Hartford Design Group was the architect. The Center now brings a much expanded environmental education program to the community and serves as a training facility to students at the College. A nature trail has been developed through a small portion of the adjacent Bolleswood Natural Area and a delightful interpretive trail guide has been published.¹⁵

The Orlando Hempstead farm, located just to the north of the Gallows Lane Extension, was remarkable for having remained continuously in the ownership of direct descendants of James Rogers, one of the original settlers of the Colony, for over two centuries and seven generations. The land had been actively farmed up to 1917, the year Mr. Marion Faraci purchased it from the children of Julia Rogers



The interpretive headquarters of the Thames Science Center photographed shortly after its construction in 1970 on the Gallows Lane Extension.

Hempstead; and portions of its were cultivated, mowed, and pastured by him until shortly before its acquisition by the College in 1950. For a number of years previous to that date the barn on the property had been leased to Mr. Haviland for use as a riding stable. Mr. Faraci was a member of the College's grounds personnel and also did maintenance work for the Arboretum. In 1948, an option was negotiated with him to purchase the farm, with the exception of the residence and life use of a garden plot. The \$1,500 option payment was raised by twenty-four friends of the Arboretum, who later contributed an additional \$1,500 to extend the option period. Mrs. S. H. Williams, a Trustee and founder of the College, who was always an enthusiastic supporter of the Arboretum, promoted this purchase at each meeting of the Trustees. Favorable action was finally taken to complete the transaction late in 1950 with a College appropriation of \$4,500. This property (*Tract 9*) is now named in honor of Mrs. Williams.

Subsequent to acquisition, the barn was renovated as the College riding stable, operated by Mr. and Mrs. Joseph Porter and two riding rings were constructed. All the land to the west of the riding rings became part of the Arboretum, and the section west of the telephone pole grant, which has now been abandoned, was added to the Bolleswood Natural Area in 1952.

The rights to the garden plot were purchased from Mr. Faraci in 1964 and the house and lot (*Tract 9a*) from his son in 1972. The house was then sold to a member of the College faculty.

To the west of these two farms and separated from them by the old dirt lane known from Colonial times as Samuel Bolles Road lies a very rocky piece of woodland, broken by swamps and ledges and traversed by the stream that crosses Gallows Lane to flow south through the Ravine. At the southern edge, tucked in between the Red Maple Swamp on the east and a cliff dropping off to the brook on the west, is a small house with frontage on Gallows Lane and a delightfully secluded clearing shaded by fruit trees. In early 19th century deeds, this tract was described as roughly triangular and of about 25 acres. It was a disjunct woodlot belonging to what was referred to as the "Quaker Hill Farm" or the "Frink Farm," which was owned for a time by the sea captain, Daniel Deshon. The farm was broken up in 1885, and the woodlot passed through a number of hands before it was acquired in 1948 by Mr. and Mrs. Carlton S. Monroe, both of whom were employees of the College. The Monroes had no need for the wild land surrounding their house and therefore agreed in 1950 to sell 15.7 acres for \$1,400. Thirty-one people contributed \$1,665 toward this project. This property, now known as the *Monroe Tract (Tract 10)*, was surveyed, purchased by Dr. Goodwin as trustee for the donors, and then conveyed to the College with the stipulation that it should be used for Arboretum purposes.

Shortly prior to acquisition of this tract by the Monroes, the trees in the portion of the Red Maple Swamp north of Gallows Lane had been cut for firewood. This had the effect of encouraging the shrub understory of winterberry, highbush blueberry, and water willow. Now, after thirty years, red maples are again beginning to overtop the shrubs. One interesting feature of this wild piece of country, which was included within the original boundaries of the Bolleswood Natural Area when it was established in 1952, is a rocky ridge surrounded by wooded wetlands on which may be found a pure stand of chestnut oak—a species relatively uncommon elsewhere in the Arboretum woodlands.

In 1956 the Monroes sold their house and lot (*Tract 10a*) to the College, and the Arboretum Advisory Committee provided \$3,000 toward the \$8,500 purchase price. The College has made a number of capital improvements on the house, which has since been in continuous use as a residence for members of the faculty.



View from a ledge on Tract 24 looking south along Bolles Road, taken in 1957. The small pond in the right foreground is the site of behavioral studies of the spotted salamander. Behind the first stone wall, to the left of the road lies the

Just to the west of the Monroe house on Gallows Lane, two fields slope gently to the stream that traverses its eastern edge before dropping into the ravine. A well on the northeastern section of the property, near the stream, suggests that a dwelling may have been constructed nearby, but foundations are not in evidence. In 1904, the property was acquired by the Perry Ice Corporation, which operated an ice house on ponds a mile downstream near the present site of the Holiday Inn. The low land along the stream may have been used to impound run-off from the watershed, as it was in the early 18th century by a mill dam¹⁶ constructed where Gallows Lane crosses the brook. The area is still subject to periodic flooding, especially during the early months of the year.

The property became available for purchase from the late Grant D. Bliven in 1954, just at a time when efforts were being directed toward fund-raising for Mamacoke Island. In order to save this piece of land from development, Dr. Goodwin purchased it personally. In 1956, at a dinner celebrating the 25th anniversary of the founding of the Arboretum, the Director was presented with a check for \$2,250 to cover his expenses in holding the property for the College. The money was contributed by seventeen of his friends, who intended this land to be added to the Arboretum. It is now named the *Richard Hale Goodwin Tract (Tract 14)* in his honor.

By 1950, the Arboretum owned both sides of the first quarter of a mile of the old unpaved way known as Samuel Bolles Road, leading north from Gallows Lane between the Monroe Tract on the west and the Gallows Lane Extension and Williams Tract on the east. Traversing uninhabited country, it ended about half a mile further up in the front yard of the Burdicks, the only family having use of the road. Their house, overflowing with as many of their eighteen children as were still at home, boasted seven rooms but none of the modern amenities, such as electricity, telephone, and running water. A bucket on a rope serviced the well in the front yard. There were an outhouse, a shed, a two-cow barn, numerous other structures providing shelter for a wide assortment of domestic animals, a small



Burdick Tract (Tract 17); and to the right, the Hirschfeld Farms (Tracts 18 and 20). Connecticut College buildings, including the Chapel spire, can be seen on the skyline to the left.

garden, and a few fruit trees. Burdick used an old unregistered jalopy to get over the rough road and picked up his regular car at the south end near Gallows Lane to commute to work.

Numerous encroachments such as the dumping of rubbish, the kindling of brush fires, and vandalism of various sorts were taking place along the road. It became evident that it would be of great advantage to the Arboretum if it were possible to close off the road to vehicular access. The opportunity arose.

One morning late in 1956, Dr. Niering, then assistant to the Director, chanced to talk to Mrs. Burdick as she was walking along Gallows Lane. He discovered that the Burdicks were negotiating the sale of their house and four acres. When told about this ten minutes later, Dr. Goodwin, who was just leaving on a trip to Washington, authorized Dr. Niering immediately to offer Mrs. Burdick \$200 more for the property than the other party. Thus, the Goodwins suddenly came into possession of the only residence on Bolles Road for \$1,750. A metal barway was promptly installed at the Gallows Lane entrance, and most of the encroachment problems became resolved.

A walk up Bolles Road today can be a rewarding experience. Commencing at the barway, one first passes east of high ledges on which is perched a large glacial erratic. Farther up, a break in the wall gives access eastward to the pine grove planted on the Williams Tract. The road next passes below a 25-foot cliff, a boggy woodland extending to the west. At this point, thanks to the broken nature of the terrain, one gets the impression of being in the wilderness. Although only about a thousand feet from well-travelled highways, this old road is leading into the heart of nearly two-thirds of a square mile of abandoned farmland. A steep pitch brings the visitor to the crest of the ridge, which he follows for over half a mile before reaching the site of the Burdick homestead, nestled in a slight depression in the height of land.

When first acquired, the Burdick property was heavily littered with discarded furniture, fragments of cars, cans, and broken glass. Much of this material was

picked up and removed, and a small cellar hole was filled with metal scrap. It was thought at first that the house might have some possible recreational use, but examination showed it to be in an unsafe condition. The following fall, arrangements were made for the Quaker Hill Fire Company to burn it down. The day set for the event was too dry and windy, however, and the attempt was abortive. In the late winter, Mr. Stengel, the Arboretum horticulturist, was asked to set fire to some of the outbuildings as the next step toward returning the property to its natural state. The appointed hour was eight o'clock one cold March morning in 1958, when sleet covered the ground. The Director and his wife bounced up the road at 8:30, camera in hand, to document the event. When they arrived on the scene, they found Mr. Stengel looking a little white. He had barely managed to back his vehicle to safety. The entire complex of buildings had been reduced to ashes, the fire having spread rapidly from the first shed to all the other structures.

Four abandoned farms with frontage on Bolles Road still lay between the Arboretum holdings and the Burdick property. These included the headwaters of the stream that runs through the Ravine. Dr. Goodwin now urged that these properties be acquired by the College. The business manager, Mr. Allen B. Lambdin, realizing that completion of the Connecticut Turnpike would soon inflate land values, recommended their purchase to the Board of Trustees. With Trustee authorization, Dr. Goodwin initiated negotiations which culminated in their acquisition within two years.

Immediately south of the Burdick property is the homestead originally settled by Samuel Bolles in 1763. He was the fourteenth and youngest child of John Bolles and grandson of the original settler, Thomas Bolles. At the age of nineteen, he built his own house on a "wild and rocky lane leading from New London to Norwich,"¹⁷ which later took his name. The land was a gift from his father. Samuel lived to the ripe old age of 98. His heirs sold the property in 1844 to Thomas Calvert for \$390, and it remained in the possession of the Calvert family for a full century.

The old colonial farm finally fell apart. The barn blew down in the 1938 hurricane, and the dwelling burned to the ground five years later. The stone foundations, distinguished by an arched crypt under the central chimney, the well, and a nearby sheepfold are still in evidence. This house site has been excavated by a College anthropology class under the direction of Professor Harold Juli.¹⁸

Edward and Stasia Hirschfeld acquired the property from Thomas Calvert's granddaughter in 1944. They pastured one or more cows on the farm up to the time of its purchase by the College. The land (*Tract 18*) is now administratively assigned to the Arboretum; and the portion lying west of the telephone pole grant, which includes the headwaters of the stream that flows through the Ravine, was added to the Bolleswood Natural Area.

Part of the property acquired by Dr. Goodwin from the Burdicks was a narrow strip lying east of Bolles Road that they had purchased from the Hirschfelds in 1952. Another building had been started at the southern tip, but construction had never gone beyond the beginning of an excavation. This piece was also bought by the College (*Tract 17*).

Between the Edward and Stasia Hirschfeld property and the Monroe and Goodwin tracts to the south lies a portion of a farm that had been acquired by Edward's father, Karol Hirschfeld, in 1933. Prior to 1842 it had been in the possession of Samuel Bolles. In 1949 Mr. Hirschfeld had given this land and farm buildings to his daughter, Jennie, with a life interest to his wife. After her marriage, Jennie transferred title in the land to her husband, John Jaszczur, who shortly thereafter deserted his wife and abandoned all his family responsibilities.

Through legal action mediated by the College, title to the property was obtained from Jaszczur in 1960 and divided between Karol Hirschfeld's widow and the College, Jennie having died in the interim. Mrs. Hirschfeld got the house, outbuildings, and surrounding farmland fronting on Bloomingdale Road; the College, the eastern fifty acres. The cost of the entire transaction was \$6,000, of which \$2,500 was contributed by five individuals and the Connecticut Arboretum Advisory Committee.

After acquisition, the College's fifty acres (*Tract 20*) were administratively assigned to the Arboretum; and the section lying west of the telephone easement, as in the case of the Edward and Stasia Hirschfeld property, was added to the Bolleswood Natural Area. Today much of this land is wooded. The headwaters of the stream that flows into the Ravine runs between a high cliff on the west and rocky slopes covered with dense laurel thickets on the east. Along Bolles Road some open land, formerly pasture, still persists. Large cedar trees, blueberry and huckleberry clones, and brier thickets have developed in the grassland.

In 1970, a new water main was installed along Gallows Lane to service the Quaker Hill section of Waterford and northern New London. The College was fortunate to be able to exchange with the City of New London a one-acre site for a water storage tank on high ground just north of Gallows Lane on the Hirschfeld Farm for the two compensating reservoirs at the center of the campus which can be seen in the aerial photograph shown on page 26. This transfer was vital to the development of the College, as it made possible the construction of the new library at this key location.

Two properties east of the Hirschfeld farms, lying between Bolles Road and Williams Street were also acquired by the College. One, just north of the Williams Tract, was the 50-acre *Coffey Farm (Tract 19)*. The old Colonial home fronting on Williams Street is still standing. The late Mr. Elmer Keith, an expert on old houses, estimated it to have been constructed around 1810 on the foundations of an older house that had burned down. This house has been nicely renovated by a retired member of the College faculty. A high outcrop at the southwestern corner of the farm has been assigned to the Arboretum. It gives important buffer protection to the Bolleswood Natural Area. The Coffey Farm is extensively used by the College riding program.

The other property was the 28-acre Brailsford purchase (*Tract 16*), the abandoned farmland remaining after Mr. Brailsford's housing development. A noteworthy feature of this tract is a wooded swamp at the head of Totoket Road and adjacent to a house and lot (*Tract 16a*) subsequently purchased by the College for a faculty residence.

The 2.5 acres of the Burdick property still retained by Dr. Goodwin had been acquired by the Burdicks from the Norman A. Richards farm. Harold Dunbar, who operated the Scotch Cap Service Station on Williams Street, and other members of his family bought the remainder of this farm in 1956. Three years later, Dr. Goodwin purchased from them an additional 22 acres of this land, which adjoined the Edward and Stasia Hirschfeld farm on the north and the Burdick lot on the north and west.

Four acres of this block (*Tract 23*) were given to the Thames Science Center, which, in turn, gave them to the College in consideration of a lease of the site for its interpretive building on Gallows Lane. The remaining 20.5 acres (*Tract 24*) were given directly to the College by Dr. Goodwin over the next three years in undivided fractional interests. The use of this land was legally restricted to Arboretum purposes. The physical feature of especial interest on these tracts is a small pond fringed by wetland shrubs, which have been mapped in detail as a student



Aerial view of the Connecticut College campus taken in 1934, showing newly constructed Harkness House and the two compensating reservoirs of the City of New London, now the site of the new College Library. The Washington Entrance to the Arboretum and the Laurel Walk are at the lower left, as is the south nursery. The large white house on Williams Street with conspicuous cement driveway, recently completed for Professor Carola Ernst, is now the President's residence. Mamacoke Island, connected to the Avery Tract by salt marsh, shows clearly at the upper left, opposite the U.S. Submarine Base.

project.¹⁹ This pond has been used for intensive zoological investigations of the migratory behavior of salamanders. A very handsome white oak 3.4 feet in diameter is growing near the southern boundary.

The acquisition of Tracts 17, 18, 19, 20, 23 and 24 has made it possible to develop a safe and attractive system of bridle trails for the College riding program immediately accessible from the stable. Trails which the Porters constructed on the Avery and Matthies tracts in the 1940s had to be abandoned around 1954, as by then the traffic had become too hazardous to ride across Mohegan Avenue.

In 1970, the College purchased an additional 32 acres immediately north of the Goodwin gift from the Lodus Realty, Inc. (Tract 25). This property was another piece of the Norman A. Richards farm which the Dunbar family had sold to the Lodus Realty. It is now almost all wooded and slopes off to the north. Access is by a right-of-way from the end of Dunbar Road.

Only one more piece of property now separated the Lodus Realty Tract from the banks of Hunts Brook to the North. This 34.5-acre tract was mostly oak woodland with a house and four-acre field fronting on Bloomingdale Road at the northwestern end. It became available for purchase in early 1975. A complex arrangement was worked out whereby the southern 24 acres (Tract 26) were purchased for the Arboretum. The remaining ten acres, including the house and field, were acquired by Thomas F. Ammirati, associate professor of physics at the



Aerial view of Connecticut Arboretum and College campus from College Chapel northward. Arboretum Lake has been drained; boulders and stone wall crossing it are evident. The Outdoor Theatre is light rectangular area surrounded by hemlocks. Other dark areas near lake are pine plantations. Bolleswood Natural Area is in center foreground with darker hemlock area on ledge and adjacent ravine. Right-of-way Vegetation Management Demonstration Area is on transmission line in foreground. A portion of Gallows Lane passes near water tank. Mamacoke Island, connected to the Avery Tract by salt marsh, shows clearly at the upper right. Compare semi-open aspect of the areas in earlier photograph with wooded aspect today. New College Library now covers site of two compensating reservoirs. Photograph by Virginia Welsh, March 1982.

College, and his wife, Theresa. The cost of the Arboretum addition was \$16,400. Dr. Niering, who had succeeded Dr. Goodwin as Director in 1965, mounted a successful fund-raising drive, to which forty individuals and four organizations contributed. The steep wooded slopes along Hunts Brook, the forested back land, and a right-of-way between them (*Tract B*) were then protected by a conservation restriction purchased from the Ammiratis for \$2,500 by the West Farms Land Trust. This organization had been established in 1973 for the purpose of preserving natural resources, especially in the Town of Waterford. Dr. Goodwin was its first president.

With the completion of these transactions, two miles of green belt had been established extending northward all the way from the State Wildlife Sanctuary in New London and Mamacoke Island in the Thames River to the West Farms Land Trust easement on Hunts Brook. The Arboretum had grown to six and a half times its initial size at an average cost of about \$325 per acre. Gifts of money and land from friends of the Arboretum exceeding \$90,000 accounted for approximately eighty percent of the cost of these acquisitions. During the same period the College had acquired six houses, a riding stable and 111 additional acres for a little short of \$200,000.

The Plant Collections

From the outset the Connecticut Arboretum has specialized in the native flora. It has been a basic principle in developing the woody plant collections that only those species of trees and shrubs native to eastern North America are to be introduced. Ornamental exotics and horticultural varieties have been added to the Black Botanic Garden and the Campus plantings.

Portions of the new tracts that had been added to the Arboretum between 1942 and 1950 were still open fields at the time of acquisition. An active reforestation program was undertaken, and approximately 10,000 conifer seedlings were planted on portions of these tracts between 1945 and 1953. These have flourished in the intervening years and are now maturing into forest plantations.

Due to budgetary strictures, great care has always been taken to maximize the efficiency of the maintenance operation. An effort has been made to place new specimens in environments where they will thrive under a regime of benign neglect. Prunings, when made, have been piled and allowed to decompose naturally. Very recently a chipper has been employed and the wood chips used to mulch the shaded trails. No pesticides and very little fertilizer have been used.

For many years, the work staff consisted of only one full-time employee and additional part-time and student help during the summer months. What has been achieved has been due to the interest, dedication, and skill of these men. Much of the stonework in the Arboretum and Caroline Black Botanic Garden, for example, was created by Joseph Miceli. A Sicilian by birth, Mr. Miceli worked for the Botany Department and Arboretum for 24 years until his retirement in 1959. William C. Peck started his career at the Arboretum shortly before World War II. He returned after his tour of military service and was on the staff until 1952. From 1952 until 1965, Dr. William A. Niering, a full-time teaching member of the faculty in the Botany Department, served as Assistant Director, after which he assumed the duties of Director. John Stengel, who received his early horticultural training in Germany, became employed by the College on the grounds staff. In 1956 Big John, as he was affectionally referred to, became the Arboretum horticulturist and served most effectively in this capacity until his terminal illness in 1974. During his tenure a second full-time position was filled by Craig O. Vine, who is now the Assistant Horticulturist. Alan R. Smith filled the position of Horticulturist from 1974 to 1979, when James T. Robinson assumed duties as full-time Assistant Director.

After World War II and for a period of about fourteen years until his death in 1959, Kaleb P. Jansson continued to serve as collector and taxonomist for the Arboretum, partly in a volunteer capacity and partly funded by small grants from the Connecticut Geological and Natural History Survey. For years he had been corresponding with and collecting for the famous botanist, Liberty Hyde Bailey. In 1950 he helped to make an inventory of the woody plants growing in the Arboretum, and a check list and guide to the plantings was published as Bulletin No. 6.²⁰ Four hundred and nine taxa were recognized. About a dozen of these were on the Campus or in the Botanic Garden, all the remainder in the Arboretum. Two special collections were included—63 species of brambles (*Rubus*) and 35 species of goldenrods (*Solidago*).

In 1950 the Board of the Federated Garden Clubs of Connecticut gave a stone bench and handsome ornamental planting at the rear of the outdoor theatre in memory of their deceased member, Prudence Demarest. Later, in 1956, the Arboretum received \$500 from the same Board in memory of Edna Edgerton, who had been a faithful and enthusiastic member of the Arboretum Advisory Committee. This gift formed the nucleus of an endowment to help maintain the

wildflower area which has been developed in Mrs. Edgerton's honor. Later, in 1975, a southerly extension of this garden was dedicated to the memory of Mr. Stengel.

An ambitious student project undertaken by Sara Manwell Bradford '63²¹ culminated in the publication in 1965 of Bulletin No. 15, a complete flora of the vascular plants found in the Arboretum.²² This not only updated the 1950 listing of trees and shrubs but also added data on the distribution of both the woody and herbaceous plants within the expanded Arboretum and a description of the various vegetation types. A total of 850 taxa were listed. Since then a form of pitcher-plant new to New England has been discovered in the bog.²³ In the 15-year interval since the publication of the first check list, the collections of *Rubus* and *Solidago* had deteriorated due to lack of manpower. About 32 other species of woody plants had been lost and 25 new ones added.

A gift from Mr. Marshall A. Fine in memory of his wife, Nancy Moss Fine '51, made possible in 1980 the planting of a fine collection of native azaleas. This development has been done under the supervision of Mrs. Sally Taylor.

In 1980 James Robinson made a new check list of the trees and shrubs in the plantings.²⁴ This has been the first step in a new effort to fill gaps in the collection, some of which have resulted from further losses of species from the 1950 inventory.



Hepatica americana blooming in the Edna Edgerton Wildflower Garden. Photo by JoAnn McKeon '75.

Education, Community Service, and Public Support

The Connecticut Arboretum, which now protects the Connecticut College campus from urban encroachment with an attractive rural greenbelt, provides the institution with an extraordinary outdoor laboratory within a five-minute walk of the classroom. Not only have the plant collections been most useful in providing living material for the botany classes, the introductory and intermediate biology courses have been making increasingly effective use of the many different habitat types—old fields, thickets, deciduous and evergreen forests, rock outcrops, swamps, bogs, and salt marsh—in teaching ecology. Perhaps even more important has been the use of the natural areas and adjacent tracts in student and faculty research.²⁵ This will be discussed in a later section. Suffice it to say that at least 45 undergraduates and ten graduate students have completed special projects that have added to the substantial data base on the natural history of the area. Another 29 students have participated in the long-range vegetation studies that will be described. The area encompassed by the Arboretum is also rich in history, providing fascinating opportunities for archaeological investigations of Indian and Colonial sites.

The research program and demonstration areas have attracted the interest of scientists at other institutions, such as the Yale Forestry School and the University of Connecticut, who bring their classes and graduate students to the Arboretum for guided tours. In order to further maximize the educational usefulness of the Arboretum beyond the walls of the College, particularly in view of the true limitations of the staff, Bulletin No. 16 was prepared to serve as a self-guided tour of the Arboretum plantings.²⁶ In addition, the Thames Science Center extends the program to the young people in southeastern Connecticut by conducting classes and leading field trips through the area. The Center has also developed its own nature trail through a small section of the Bolleswood Natural Area.¹⁵

It seems obvious that the propinquity of a natural area to a college campus is of the utmost importance to its successful use. It takes no complicated mathematics to show a direct relationship between cost of research and the distance of the area being studied from home base; also an inverse relationship between personnel efficiency and distance. These relationships are more or less exponential; thus doubling the distance quadruples the cost and quarters the efficiency. A survey was made in 1963 of educational institutions known to have tracts of land that could conceivably be considered natural areas. Data were obtained from 56 colleges and universities. If one excluded natural areas provided with special contiguous research facilities, only four had natural areas in excess of 100 acres located within less than a mile of the classroom. They were the University of Wisconsin, Antioch College, Principia College and Connecticut College.²⁷

The cultivated portion of the Arboretum, which is open to the public during daylight hours, has been serving for many years as New London's most attractive park and is much used for passive recreation. Hundreds of people visit the area on pleasant weekends in the spring and fall. In winter months, the Lake has been a popular place for skating, whenever conditions have allowed. For twenty-five summers, beginning in 1945, the Connecticut Trails Council of the Girl Scouts ran a day camp in the Arboretum, using Buck Lodge as their base of operation.

Other recreational activities take place elsewhere. Jogging has become so popular that it has been necessary to restrict this activity to the Matthies and Avery Tracts. Both the College students and the Coast Guard Academy cadets use the trails in this section in their cross country programs. The Arboretum and the Athletic Department have worked closely in recent years to improve the trail system. The College riding program also uses the Arboretum and bridle trails lead



Margaret K. Hazlewood, retired Assistant Professor of English, seated in the woodland near the Outdoor Theatre. Taken in 1981.

out from the stable on the Williams Tract to the Hirschfeld farms to the northwest. A ballfield on the Matthies Tract was leased to the Waterford Little League from 1956 to 1980.

Public support has been a crucial factor in the successful development of the Arboretum. Through the years, this has come in the form of dues and special contributions from members of the Connecticut Arboretum Association individuals and Connecticut Garden Clubs. In return, members have received the Arboretum bulletins, some of which, such as the *Garden Guide to Woody Plants*,²⁸ have had a special appeal to gardeners. They have also been provided a variety of activities and services. These have included special lectures and Audubon Screen Tours—some of these cosponsored with the Thames Science Center—guided field trips, and short one- or two-day training sessions or workshops. One of the most significant of these workshops was a Civic Planting Conference held at the College in 1949, which for the first time brought together citizens and professionals throughout the State who were actively involved with the planting and care of trees and shrubs in the various communities. Commencing in the 1930s, the Arboretum has provided garden clubs with free nursery stock for their civic planting projects. Over the intervening years, over 10,000 flowering dogwoods and other species of native trees and shrubs have been distributed. At the 50th Anniversary of the Arboretum the Director reported that individual memberships stood at 305 and organization at 105.

The Connecticut Arboretum was completely unendowed during the first twenty-five years of its existence. However, at the time of its 25th Anniversary, a very modest beginning was made with a few initial contributions to an endowment fund. This has gradually grown during the second quarter-century through life memberships in the Arboretum Association, special gifts, a memorial fund for the care of special trees in memory of Gertrude V. Brown, and in 1971 a \$100,000 bequest from the estate of Rosamond Danielson, who was for many years an enthusiastic member of the Arboretum Advisory Committee. The general endowment, including the Brown Memorial Fund, now stands at \$196,066, with special funds for the maintenance of Buck Lodge, Mamacoke Island, and the Edgerton Wildflower Area adding another \$39,561 to the total. At the 50th meeting of the Connecticut Arboretum Association the Director announced the opening of a fund drive to bring the endowment fund to \$500,000.

The Research and Conservation Programs

William A. Niering

The first scientific investigation at the Connecticut Arboretum was an analysis by Dr. Avery and his colleagues of the growth of the Bolleswood hemlocks that were windthrown in the great hurricane of 1938.¹ A study of their growth rings showed, among other things, that the older trees had become established in the forest around 1768.

Natural Areas

The research program of the Arboretum did not really begin to take shape, however, until the establishment of the Bolleswood Natural Area in 1952. This development was a direct result of Dr. Goodwin's interest in and concern for the preservation of natural areas. Early that year he became the Connecticut representative of the newly formed Nature Conservancy, and later in the spring the Arboretum hosted a conference on the natural history of Connecticut.²⁹ The purpose of the conference, which was sponsored by the Connecticut Geological & Natural History Survey, was to obtain advice and direction from the biologists



Madge Landon West '56 (left) and Ann Beck McGeorge '55 mapping the vegetation along one of the permanent transects in the Bolleswood Natural Area in 1953.

within the State for the Survey's research and publication program. The Arboretum Director was then serving as the Connecticut College Commissioner on the Survey. Several eminent ecologists—Dr. Paul B. Sears, Dr. Harold Lutz and Dr. Frank E. Egler—were in attendance at this conference.

Among the recommendations that emerged from this conference were two that had a significant impact upon the Arboretum's development. The first was to establish a state system of natural areas designed to preserve Connecticut's natural diversity; the second, to institute long-range ecological studies on some of these preserves. The visitors were much impressed by the potential of the Bolleswood as a natural area and as a place to initiate such studies. That May the Trustees of Connecticut College, at the recommendation of the Arboretum Director, approved the establishment of the Bolleswood Natural Area.³⁰ Three years later the Mamacoke Natural Area was established.³¹

In the summer of 1952 long-range studies in the Bolleswood Natural Area were begun. Seven students surveyed and marked four permanent lines across the Bolleswood under the Director's supervision and began the task of carefully mapping the vegetation for a width of six meters along these transects. The transects traversed a variety of habitats: lake shore, open bog, red maple swamps, rock outcrops and ledges, forested ravine, intermittent stream, oak, oak-hemlock and hemlock-hardwoods forests, thickets and fields recently abandoned from cultivation. The data recorded included the location, diameter, height and identification of each tree, the location and number of stems of each species of shrub, the presence and percentage cover of the herbs and seedlings of the woody plants, and the density of the forest canopy. Also noted were the type of soil, steepness of slope, and the presence of boulders and bedrock outcrops.³² The data along the transects are being up-dated every ten years. Thus far 40 undergraduates have been involved in this field work during the summer months. It is now possible to document rates of tree growth, changes in the density of each species of plant, and many other processes over a period of two decades.

Dramatic changes have already been recorded. The abandoned fields have now grown up to thickets and early post-agricultural forest. Marsh vegetation has invaded the lake margin. Forested sections have been recovering from the hurricane. Under fire protection hemlock has been increasing at the expense of the hardwoods, especially on sites where it was already present. Investigations of this type are rarely undertaken, but they can yield very significant information. It is hoped that they may be continued for as long as the Arboretum remains in existence.

The transect data have provided base-line information for at least eight student papers describing vegetation dynamics in various habitats—bog, old fields and forest.³³ The most sophisticated of these is a master's thesis by Harry Hemond,³⁴ who transferred the tree data onto cards for a computer analysis of the changes taking place in the forest.

In addition to gathering transect data, a number of other projects have been initiated in the Natural Area. One of the first was conducting a breeding bird census, following the technique established by the National Audubon Society. Since most of our song birds are very territorial, the method consists of determining the number of breeding pairs of each species by locating the territories of singing males. The data are reinforced wherever possible by finding active nests and observing feeding activity. These censuses have now been repeated nine times since the initial one conducted in 1953 and have involved the participation of five undergraduates and two graduate students.³⁵ An analysis of these data has been completed by a former undergraduate who has not only found that the spectrum



Vegetation change that has taken place in 24 years at the western end of permanent transect III (offset) in the Bolleswood Natural Area. Above: An old field of grasses and goldenrod taken in 1953. Below: View from the same point in 1977, showing black cherries and shrub growth that have replaced the old field vegetation.



of species has shifted as the open old field vegetation has grown up to forest; but also that the abundance and diversity of the forest species have declined and given way to increases in suburban species. Thus birds of the open fields and thickets, such as the pheasant, prairie warbler, goldfinch, field sparrow and song sparrow have disappeared. In the forest, on the other hand, the ruffed grouse, flicker, wood pewee, black-throated green, Canada warblers have disappeared and the populations of red-eyed vireos and hooded warblers have declined, to be replaced by tufted titmice, robins, northern orioles, cardinals and house wrens. These latter shifts may be due partly to impacts of urban disturbance and partly to the isolation of the Natural Area from the surrounding countryside as it has become enveloped by suburban development.³⁶ Data on the winter bird population³⁷ and on small mammals³⁸ have also been obtained.

Numerous additional student projects have been adding to our understanding of the enormously complex processes that have been and still are taking place in the Bolleswood. One of these was undertaken by Nellie Beetham Stark '56, who is now Professor of Forestry at the University of Montana. For an honors project she attempted to unravel the vegetational history of the Bolleswood.³⁹ This study employed two approaches. The first consisted of an analysis of the pollen grains preserved in the peat of the Red Maple Swamp. Her first encounter with this deposit was when she sank in up to her hips attempting to cross it. Upon probing later with a Davis peat sampler it proved to be twenty-four feet deep. By a microscopic examination of peat samples extracted from various depths it is possible to identify the different types of pollen and then to construct a pollen profile, which shows the percentages of pollen of the various types preserved in each level of the deposit, the oldest being at the bottom and the youngest at the top. The age of the peat can be determined by radio-carbon dating. In glaciated regions peat deposits such as this one in the Red Maple Swamp are post-glacial features. The percentages of pollen at any given level give a direct indication of the flora growing in the vicinity of the bog at the time of deposition, while the profile gives an overview of the changes that the vegetation has undergone since the glacial retreat. In brief, the profile for the Red Maple Swamp shows an initial open tundra-like flora which occupied the area exposed by the melting ice. This is followed by a period dominated by spruce and fir, which, in turn, gave way to pine and finally to oak-dominated hardwoods forest somewhat similar to the one still present today.⁴⁰ Based on radio-carbon dates the spruce forest occurred between 10,000 and 13,000 years ago. These findings have been confirmed and elaborated by an additional profile⁴¹ from another Arboretum wetland and from elegant studies made by Dr. Margaret B. Davis at Rogers Lake, ten miles to the west.⁴²

Miss Beetham's second approach consisted of a careful field examination of the forest for more recent evidence of change. In the upper layers of the soil she found charcoal derived from past wildfires and numerous wind-throw mounds produced by the root systems of trees upturned by hurricanes. The latter indicated at least four major windstorms, three of them preceding the one in 1938. One of these was undoubtedly the blow of 1815, which has been historically recorded for the New London area. Another student has subsequently studied the effect of windthrows upon the forest community.⁴³

The age of laurel bushes was the subject of another investigation. By sectioning root crowns of large specimens and counting growth rings, Elizabeth Deane Loutrel '67 was able to establish that some of these shrubs were at least 120 years old.⁴⁴ They may have seeded in on mossy surfaces when the now forested area was used as pasture.

Rock outcrops have also received special attention. Barbara Rice Kashanski '54



The Arboretum Lake looking toward the Outdoor Theatre. The College chapel steeple shows in the background. 1953.

described in detail the vegetation development of lichens, mosses and vascular plants on rock surfaces.⁴⁵ In 1965 Christopher Gross established permanent quadrats, which have been subsequently restudied.⁴⁶ It turns out that lichen colonies are not nearly as static as they may appear. They grow, become senescent and are then replaced by new colonies of the same or different species. Another study has been made of the lichen growth on the trunks of oak trees in the Arboretum and at sites nearer to and more remote from sources of atmospheric pollution.⁴⁷ There was a good positive correlation between the diversity of species present and distance from the source of pollution.

The Arboretum lake at the edge of the Bolleswood Natural Area has provided an excellent aquatic habitat for several student investigations. One of these dealt with the ecology of the insect fauna,⁴⁸ two with microscopic algae and invertebrates⁴⁹ and a fourth with the painted turtle population.⁵⁰ It is interesting to note that the oldest turtles were found to be about as old as the lake itself, which was formed in 1928. A small pond on Tract 24 has been the site of interesting investigations of the migratory behavior and population variation of the spotted salamander.⁵¹

The Mamacoke Natural Area has also been studied. The most extensive investigation of the upland was conducted by Elizabeth Haines '62,⁵² who, since then, has obtained her doctorate and now teaches in Arizona. Two other reports on the upland⁵³ and seven on various aspects of the ecology of the salt marshes and the adjacent Avery Cove Marsh have been completed.⁵⁴ An archaeological survey has revealed evidence of early Indian occupation.¹⁴

An undergraduate honors study dealing with seasonal changes in the soil microorganisms in forests and adjacent fields⁵⁴ and other studies conducted by students taking animal ecology have provided valuable data on the populations of small mammals in the old fields,⁵⁵ on the density and diversity of the soil fauna,⁵⁶ and on the insects pollinating jewelweed.⁵⁷

The recommendations made at the Conference on the Biology of Connecticut had further repercussions. In 1952 the Connecticut Geological & Natural History Survey established a Committee on Natural Areas which shortly thereafter was taken over by the Connecticut Forest and Park Association. Dr. Goodwin and later Dr. Niering served as Chairmen. The Committee laid plans for a natural areas preservation program for the State⁵⁸ and, by 1956, had embarked upon its first project—the acquisition of the Beckley Bog in Norfolk. Fund-raising for this purchase was coordinated by the Arboretum staff. This natural area is now known as the Frederic C. Walcott Preserve of The Nature Conservancy and has received recognition by the National Park Service as a Natural Landmark.

The Connecticut Chapter of The Nature Conservancy was established that same year to take over the functions of the Committee on Natural Areas. Dr. Niering became its first effective chairman, Dr. Goodwin having relinquished the post within weeks of his election to assume the presidency of the national organization.

In celebration of its 25th anniversary, and timed for distribution at the 1956 annual meeting of the American Institute of Biological Sciences, the Arboretum published Bulletin No. 9, which described six points of especial botanical interest in Connecticut, one of them the Connecticut Arboretum.⁵⁹ These sites were chosen as being suitable for inclusion in the State's natural areas system and were on the itinerary of a field trip sponsored by the Ecological Society of America that took place immediately following the meeting. Today private organizations are giving four of these sites, or portions of them, long-range protection, and efforts are being made by The Nature Conservancy to preserve a fifth.

The past twenty-five years have seen a tremendous growth in the natural areas movement in Connecticut. Over 7,900 acres of preserves are now owned and managed by The Nature Conservancy and 81 different land trusts, which now hold 4500 acres, and a number of other agencies are giving stewardship to many other tracts. In 1969 the establishment of the Connecticut Natural Area Preserve System was established by Public Act No. 727.

Wetlands Preservation and Research

Appreciation of the need to preserve Connecticut's coastal wetlands was a direct outgrowth of the natural area movement. The issue came to a head when in 1956 the State proceeded to permit the filling of a sizeable salt marsh in Sherwood Island State Park in order to stockpile dredged fill for the construction of the Connecticut Turnpike. The artist and author, Louis Darling, was a leader in opposing the destruction of this marsh and was one of the founders of Connecticut Conservationists, Inc., an organization formed to control such dredging activities in the State. He described the Sherwood Island incident in his article, *The Death of a Marsh*,⁶⁰ in Arboretum Bulletin No. 12, *Connecticut's Coastal Marshes: A Vanishing Resource*. This Bulletin printed in 1961 documented the values of the tidal marshes,⁶¹ dramatized the rate at which they were being destroyed, and laid out a program for their protection.⁶² That same year the Connecticut Chapter of The Nature Conservancy was requested by Joseph Gill, Commissioner of Agriculture and Natural Resources, to make a survey of the tidal marshes of the State. The Arboretum staff played a key role in producing this inventory which was completed in 1962.⁶³ Bulletin No. 12 received a wide distribu-

tion, and its second reprinting in 1966 included an update on the status of the coastal marshes and citizen efforts to save them.⁶⁴ This publication was a significant factor in bringing about the passage of Public Act 695 in 1969. Since then all the tidal wetlands of the State have been mapped and given legal protection. We are indebted to the Connecticut Conservation Association for its role in militantly policing the administration of this Act.

Research on tidal wetlands by students and Arboretum staff has been extensive. In 1957, soon after the acquisition of the Mamacoke Island Natural Area by the Arboretum, the Mamacoke salt marsh was mapped in detail by undergraduates.⁶⁵ The area was remapped in 1975⁶⁶ and Dr. Bruce Leon, an Arboretum post-doctoral research associate, has initiated an analysis of the vegetation changes that took place during the 18-year interval.

In the mid-1960s a graduate student studied the unimpounded Brucker Marsh at the State-owned Barn Island Management Area in Stonington, Connecticut.⁶⁷ Since that time this marsh has become another of the several impoundments in the State's wildlife management scheme. At the request of the State in the early 1970s Drs. Goodwin and Niering prepared a status report on the impoundments and set forth land use recommendations.⁶⁸ Although the Brucker was not restored as recommended, there is now an effort to restore more natural tidal flushing in all of the Barn Island impoundments. In 1982 Special Act 82-29 to restore the Barn Island impoundments was passed.

In 1973 Drs. Warren and Niering received a grant from the Connecticut Department of Environmental Protection to undertake an extensive biological inventory of the State's tidal wetlands. This involved nearly twenty students and professional biologists. The vegetation of over 100 marsh systems was surveyed; microrelief and vegetation mapping studies were conducted on ten representative marshes by Dr. Warren with the aid of civil engineering students from the University of Connecticut; marsh invertebrate populations were studied along the entire coastline by Dr. Pellegrino of Southern Connecticut State College and Allen Carroll, one of our undergraduates; and on several marshes Dr. Paul Fell of the Zoology Department at Connecticut College, and Mrs. Nancy Olmstead, Arboretum Research Associate, studied selected marsh invertebrates. A two-volume work resulted from this assignment.⁶⁹

From peat cores obtained from this state-wide survey Carolyn Weymouth, an Arboretum research assistant, studied the preserved plant remains in over twenty cores and reconstructed past vegetation change. The ages of the samples at a depth of one meter were determined by radio-carbon dating. They ranged between 200 and 1600 years, which gives an indication of the rate of marsh development. The results were published in Arboretum Bulletin No. 22.⁷⁰

A number of other graduate theses have been completed on the ecology of tidal wetlands. These include a study of the vegetation pattern and productivity of the Cottrell Marsh Preserve of The Nature Conservancy in Stonington,⁷¹ an evaluation of the ecological status of tall and short forms of cordgrass,⁷² studies of the role of nutrients and of oxygen in controlling the distribution of plant species,⁷³ the effect of tidal gates on salt marsh vegetation,⁷⁴ documentation of the vegetation changes that have occurred in the Barn Island impoundments,⁷⁵ and studies of changes in the flora and fauna during revegetation of dredged material on Nott Island.⁷⁶

During the last decade the Arboretum has published a series of popular bulletins. The first of these was a reprint of Mervin Roberts' *A Primer of Wetland Plants*,⁷⁷ originally put out by the Old Lyme Conservation Commission. This has recently been updated with new illustrations and text as *Salt Marsh Plants of Connecticut*.⁷⁸ Three other bulletins have dealt with the seaweeds of the Connecti-

cut shore, the invertebrates of the tidal marsh, and plant and animal life of the estuary.⁷⁹ The most recent publication, *Birds of Connecticut Salt Marshes*, was written and illustrated by a husband and wife team and issued in celebration of the Arboretum's 50th Anniversary.⁸⁰ The staff has recently published an overview of salt marsh vegetation in *Bioscience*.⁸¹

By 1970 it became clear that another important category of wetlands, the fresh water marshes, swamps and bogs, that serve as built-in water storage and flood control areas were also in need of immediate protection. Housing, commercial developments, highways, drainage for agriculture, and the use of these natural features as depositories for solid waste were causing an alarming attrition of these liquid assets.⁸² With a view toward promoting their preservation the Arboretum published *Preserving our Freshwater Wetlands* as Bulletin No. 17. Following the passage of the Inland Wetlands Act in 1972, Public Act 155, there was a need for a popular guide to assist citizens administering the Act in the identification of the plants of the freshwater wetlands. The Commissioner of the Department of Environmental Protection invited Drs. Niering and Goodwin to prepare such a guide. This appeared both as a publication of the D.E.P. and also as Arboretum Bulletin No. 19.⁸³

Herbicides in Vegetation Management

Following World War II weed killers became available as a new tool in vegetation management. It soon became evident that the indiscriminate use of these chemicals along the roadsides and underneath power lines was not only killing attractive and desirable plants, but also was creating an unstable plant cover that would require continuing costly treatments. Especially along the roadsides the unsightly impact of "brown-outs" was engaging the concern of members of the State's garden clubs, many of whom were supporters of the Arboretum. Thus it came to pass that the Arboretum staff initiated a research program on the use of herbicides and began to work closely with the Federated Garden Clubs of Connecticut and the Shade Tree Committee of the Connecticut Forest and Park Association to develop ecologically sound roadside management techniques. In 1959 the Arboretum published *A Roadside Crisis: The Use and Abuse of Herbicides* as Bulletin No. 11, in which selective herbicide techniques were described.⁸⁴ A specific example of damage to trees within the Arboretum as a result of an improper roadside application by the Town of Waterford was also described.⁸⁵ By 1961 the Shade Tree Committee had formulated and adopted a set of recommendations for roadside management that were printed in Bulletin No. 13,⁸⁶ along with a somewhat disheartening analysis of what was actually happening along the roadsides of the State, county by county.⁸⁷ The front cover created a bit of a stir. It featured a color photograph of a browned-out roadside as an example of indiscriminate spraying. State highway officials, who administered the State-aid program descended on us and complained that they were being accused of a treatment for which they were not responsible. It was pointed out to them first that the State Highway Department had not been accused of treating that particular road, and second that we had even more damaging examples on file that were their responsibility. The roadside spraying program has greatly improved since that time.

In 1953 the Arboretum established a right-of-way demonstration area under a 1,500-foot section of power line that crossed the southwestern corner of the Arboretum. This became a cooperative venture between the Arboretum and the Connecticut Light and Power Co., now part of Northeast Utilities, where various spray techniques have been employed on an experimental basis.⁸⁸ The demonstration area has become a model in the sound use of herbicides in vegetation management; and the selective spray technique used at the Arboretum, which



A view of the Right-of-Way Demonstration taken in 1976 showing the relatively stable shrubland that has been created by the selective removal of tree species. Photo by Robert M. Currie '76.

involves the removal of only the undesirable woody growth, is presently written into the basic specifications employed by Northeast Utilities. The right-of-way currently exhibits a diversity of relatively stable shrub communities with high wildlife and aesthetic values. A research paper summarizing this work has been published in *Ecology*.⁸⁹ The demonstration area has frequent visitors. For example, graduate students from the Yale Forestry School visit the area annually; and last year a scientist from Nova Scotia viewed the right-of-way with the hope of utilizing the techniques in Canada. Currently a grant from Northeast Utilities is

supporting the work of a graduate student, Glenn Dreyer, who is assessing the vegetation pattern on representative rights-of-way in southeastern Connecticut, including the one crossing the Arboretum. At a news conference held in August, 1981, for the western Massachusetts area, Northeast Utilities announced this fellowship grant and credited the Arboretum with playing a significant role in assisting the Company develop its sound approach to right-of-way vegetation management.

The concept of naturalistic landscaping was developed by Dr. Frank Egler while he was experimenting with weed killers at the Aton Forest in Norfolk, Connecticut, after World War II. By selectively root-killing the less desirable woody plants that were invading his old fields he was able to accentuate the more ornamentally attractive native species, while at the same time creating a relatively stable, low-maintenance landscape.

In 1953 we established a half acre demonstration area in an abandoned orchard on the Matthies Tract. The site selected was being rapidly invaded by black cherry and a diversity of attractive woody species, including flowering dogwood, highbush blueberry and huckleberry. By removing the less attractive species—primarily the black cherry trees—with basal sprays we created a lovely semi-open naturalistic landscape with high wildlife value. After nearly three decades and very little maintenance the area is still beautiful and widely visited. As an undergraduate independent project Kristine Siewers '78 expanded the area in 1976.⁹⁰ She is currently employed in the Southwest, where she is promoting the naturalistic landscaping concept. Two bulletins and other articles⁹¹ have been published which describe our results and some of the techniques which we have found successful. The second one, Bulletin No. 21, *Energy Conservation on the Home Grounds: the Role of Naturalistic Landscaping*, has twice received favorable reviews in the New York Times and has been in great demand. It has helped many people incorporate this energy-saving concept into their home maintenance program and has stimulated at least one author to write a book on the subject.⁹²



A small grassland just north of the Outdoor Theatre landscaped with herbicides. Photographed in 1965.

Vegetation dynamics

A direct outgrowth of our work with herbicides has been an interest in the ability of certain kinds of shrub communities to resist invasion by trees.⁹³ This concept has relevance to the process which actually takes place when old fields are abandoned. For example, do shrubs invade first and prepare the way for trees, or do they act as a deterrent to their establishment? Our students have investigated the reversion of old fields to forest not only in the Bolleswood Natural Area, but in other portions of the Arboretum as well.⁹⁴ In 1967, as part of a study funded by a grant from the National Science Foundation, we established a series of shrub plots, including clones of low sweet blueberry, green brier and huckleberry. Any trees already present within these thickets were removed selectively with herbicides on the assumption that the trees and shrubs may well have become started simultaneously, when the site was more open. Over the years these shrubby communities have been periodically monitored for the presence of tree seedlings. It has been found that they are remarkably resistant to tree invasion and therefore provide an excellent wildlife cover under power line rights-of-way.⁹⁵ They are also desirable in naturalistic landscaping and in wildlife management.

It is well known that some plants produce allelopathic substances—chemicals that tend to inhibit the growth of other plants or, in some cases, themselves. Two students have investigated the possibility that the resistance of shrub communities to invasion may be due to the presence of such substances.⁹⁶ Mark McDonnell '75, working one summer on an Arboretum fellowship, investigated huckleberry clones. He found that leachate from the huckleberry leaves markedly inhibited the growth of sunflower seedlings used as test plants, suggesting that allelopathic compounds may be playing an inhibiting role in clones of this species; but it is likely that the other factors, such as root competition and shade may also be involved.

Another factor that has a great impact upon vegetation development is fire. Burning the forest and fields was practiced by the Indians in pre-Colonial times and is presently a management practice in the forests of the Southeast and on the prairies of the Midwest.

In 1967, under support from the National Science Foundation, the Arboretum staff initiated long-range studies on the use of prescribed burning in representative forest and old field plots within the Arboretum. Two experimental areas were also established in the Pachaug State Forest in Voluntown, Connecticut. All burning has been done by personnel from the Connecticut Department of Environmental Protection, and currently we are assisting them in burning selected tracts on the nearby Haley Farm State Park in Groton, where fire is being used to favor desirable shrubs and herbaceous cover, as well as to arrest unwanted woody growth in order to maintain open field habitat.

Data obtained from these experiments have given us a better understanding of the effects of such burning in southern New England. Research results were initially presented at the 1970 Tall Timbers Fire Ecology Conference⁹⁷ and more recently at scientific meetings.⁹⁸ The burned plots have been used by a number of students for independent studies on the effects of burning on species resistance, on soil microorganisms and on soil temperature;⁹⁹ the resistance of different species of trees to fire has been correlated with temperatures attained by the cambium near the base of the trunk during the burns as measured by thermocouples. Thick-barked trees are more resistant because the cambium is protected by more insulation.¹⁰⁰

It is our hope that our cooperative efforts with the state foresters will lead to the sound ecological use of fire as a management tool on State-owned lands in Connecticut. It can be used to maintain open fields and meadows for habitat



Prescribed burning of little bluestem on a fire research plot on the Avery Tract in 1980.

diversity, to improve wildlife habitat and to reduce fire hazard in certain forest areas, especially those experiencing high recreational use where man-initiated fires can rapidly get out of control due to excessive leaf litter accumulation. In the future it is hoped that prescribed burning may become an alternative to power mowing, which uses non-renewable fossil fuels. In a sense it represents a return to a technique long used by our forefathers in maintaining open landscapes in southern New England.

Research on Industrial Wastes

In Groton, Pfizer Inc. manufactures organic acids and antibiotics by fermentation processes that produce large quantities of mycelial residues as a by-product. Originally this material was considered an industrial waste and was dumped in Long Island Sound; but when this procedure was no longer permitted, the corporation found it necessary to find viable methods of recycling the material.

Since 1974 the Arboretum has worked with Pfizer Inc. in a program aimed at developing sound methods of utilizing these mycelial residues. Experimental plots were established on the Matthies Tract where the residues were applied to a plowed field in order to determine their effects on old field vegetation development.¹⁰¹ Their effects on natural vegetation and ornamental shrubs and vegetable crops in the Faculty Gardens were also tested.¹⁰² In 1976 experimental plots were established on the slopes of an abandoned gravel pit in Ledyard, owned by Pfizer, in order to evaluate the role of this material as an aid in revegetating such sites. A publication on this work,¹⁰³ which was supervised by Mrs. Sally Taylor, has brought us reprint requests from around the world.

In 1975 the Arboretum staff helped Pfizer establish a demonstration farm in Stonington, Connecticut.¹⁰⁴ After the first year the Pfizer staff, including Timothy Reynolds, one of our recent graduates, continued this field operation.¹⁰⁵

In August 1981 Arboretum Bulletin No. 26 was published by Pfizer Inc. summarizing a decade of efforts in recycling this industrial by-product. It has been found that this material can serve as an excellent soil amendment and thus decrease in part our dependence on commercial fertilizer, especially in the production of silage corn. We are indebted to Pfizer Inc. for undertaking this publication in the Arboretum's 50th Anniversary year.

Notes

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Connecticut Arboretum Publications

Bulletins

1. The Connecticut Arboretum at Connecticut College. 1934. 8 pp. Questions and answers on the Arboretum.
2. The Connecticut Arboretum at Connecticut College. 1935. 27 pp. A series of articles concerning the Arboretum, including information on the propagation of native trees and shrubs.
3. A Plant Handbook: Lists of Plants for Specific Landscape Uses. pp. 94. 1940.
4. The Connecticut Arboretum: Its Tenth Anniversary. 1941. 16 pp. Acquisition of Ravine Tract.
5. The Connecticut Arboretum: Recent Land Acquisitions. 1947. 16 pp. Acquisition of Tracts 5, 6, 7 and 8.
6. Check List of Woody Plants Growing in the Connecticut Arboretum and Guide to the Arboretum. 1950. 32 pp.
7. The Connecticut Arboretum: Its History and the Establishment of the Natural Area. 1952. 16 pp. Acquisition of Tracts 9, 10 and 11.
8. The Connecticut Arboretum: The Mamacoke Acquisition and Our Research Program. 1955. 20 pp. Acquisition of Tracts 12 and 13.
9. Six Points of Especial Botanical Interest in Connecticut. 1956. 32 pp. Barn Island Marshes, Connecticut Arboretum, North Haven Sand Plains, Catlin Wood, Cathedral Pines, and Bigelow Pond Hemlocks are described.
10. Birds of the Connecticut Arboretum and the Connecticut College Campus. 1958. 24 pp. An annotated list with seasonal records and an account of the breeding bird census program.
11. A Roadside Crisis: The Use and Abuse of Herbicides. 1959. 16 pp. A program for use of herbicides on town roads, to avoid destructive practices.
12. Connecticut's Coastal Marshes: A Vanishing Resource. 1961. 36 pp. Testimony as to the value of tidal marshes and a suggested action program. 2nd printing with supplement 1966.
13. What's Happening Along Our Roadsides? 1962. 24 pp. Roadside spray practices in the National Forests; survey of what is actually happening in Connecticut; and recommended practices.
14. Creating New Landscapes with Herbicides—A Homeowner's Guide. 1963. 30 pp. Describes formulations and techniques for elimination of unwanted plants such as poison ivy and the use of herbicides in naturalistic landscaping, wildlife and woodlot management.
15. The Flora of the Connecticut Arboretum. 1966. 64 pp. The vegetation and an annotated checklist of over 850 species.
16. A Guided Tour of The Connecticut Arboretum. 1967. 32 pp.
17. Preserving Our Freshwater Wetlands. 1970. 52 pp. Reprints of articles on why this is important and how it can be done.
18. Seaweeds of the Connecticut Shore: A Wader's Guide. 1979. 37 pp. Second ed. Illustrated guide to 60 species of algae with keys to their identification.
19. Inland Wetland Plants of Connecticut. 1973. 24 pp. Forty-five species of plants found in marshes, swamps and bogs are illustrated.
20. Tidal Marsh Invertebrates of Connecticut. 1974. 36 pp. Descriptions and illustrations of over 40 species of molluscs, crustaceans, arachnids and insects found on our tidal marshes.
21. Energy Conservation on the Home Grounds: The Role of Naturalistic Landscaping. 1975. 28 pp.

22. Our Dynamic Tidal Marshes: Vegetation Changes as Revealed by Peat Analysis. 1977. 12 pp.
23. Plants and Animals of the Estuary. 1978. 44 pp. Descriptions and illustrations of over 70 estuarine species.
24. Garden Guide to Woody Plants: a Plant Handbook: Selection and Care of Woody Plants. 1979. 100 pp. Lists and descriptions of over 500 plants useful for landscaping.
25. Salt Marsh Plants of Connecticut. 1980. 32 pp. Illustrated guide to 22 different plants that grow in our tidal wetlands.
26. Recycling Mycelium: a fermentation byproduct becomes an organic resource. 1981. 32 pp. Documents the beneficial role of industrial mycelial residues as soil amendments on ornamental plants and agricultural crops and in natural vegetation.
27. Birds of Connecticut Salt Marshes. 1981. 48 pp. Illustrations and descriptions of 24 birds commonly seen on our tidal marshes.
28. The Connecticut Arboretum: Its First Fifty Years, 1931-1981. 1982. 56 pp.

Reprints

1. Tidal Marshes of Connecticut: A primer about the plants that grow in our wetlands. 1971. 30 pp. Replaced by Bulletin No. 25.

Maps

Artistic map of the Connecticut Arboretum showing features and trails. By Allen T. Carroll.

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 Miss Betty Harlow, 6
 Miss Elizabeth H. Harris, 5, 6, 9
 Mrs. Russell Harris, 13
 Dr. Elizabeth Hartshorn, 6
 Miss Sibyl Hausman, 13
 Miss Margaret K. Hazlewood, 26
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 Dr. Katherine Heinig, 9, 10
 Mrs. John Hersey, 8
 Miss Rowene Hersey, 13
 Mr. Henry W. Hicoock, 10, 13, 14, 16
 Dr. Florence Hier, 6
 Mr. B.H. Hillier, 13
 Mr. Harry L. Hoffman, 13
 Mrs. Marion S. Hoffmann, 13
 Mr. Willibald Hoffmann, 13
 Miss Myra Hopson, 13
 Dr. J.W. Horton, 13
 Miss Louise C. Howe, 10, 11, 12, 14, 20
 Mr. Frederick G. Hughes, 4
 Mrs. Harriet Chapin Hughes, 26
 Mrs. Madlyn C. Hughes, 4
 Mrs. Hadlai A. Hull, 13

Dr. Ivor E.G. Hunter, 13
 Mrs. Ivor E.G. Hunter, 11, 13
 Dr. John M. Ide, 13
 Dr. Mary L. James, 13
 Mr. and Mrs. Fred Jansson, 13
 Mr. Kaleb P. Jansson, 13
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 Miss Alice Jennings, 13
 Mrs. B.H. Jessup, 6
 Mrs. Elizabeth Bindloss Johnson, 6, 11
 Miss Hazel Johnson, 13, 26
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 Mr. William James Morgan, 4
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 Miss Ruth Stanwood, 5
 Mr. William I. Starr, 13
 Mrs. John Stengel, 26
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 Dr. Robert E. Strider, 13
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 Mrs. Wayne Tustin, 13
 Dr. Rosamond Tuve, 13
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 Mr. Carl H. Vogt, 13
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 Mrs. William Z. White, 6, 13
 Miss Marian P. Whitney, 5
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 Mrs. Edward P. Williams, 26
 Mrs. S.H. Williams, 5, 6, 8, 9, 10
 Miss Ruth Williston, 13
 Miss Ruth H. Wood, 13
 Mr. Charles A. Woodruff, 13
 Mr. John B. Woodruff, 13
 Mr. Percival C. Woodruff, 13
 Mr. Robert Wosak, 13
 Miss Elizabeth C. Wright, 5, 6, 9, 12
 Mrs. Martin W. Wright, 13
 Miss Mary C. Wright, 5, 6
 Mrs. Martha M. Young, 6
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Director, William A. Niering
Technical Advisor, Richard H. Goodwin
Associate for Community Projects, Sally L. Taylor
Research Associates, R. Scott Warren, Randall J. Ameenle
Assistant Horticulturist, Craig O. Vine

The Connecticut Arboretum Association

Membership is open to organizations and individuals interested in supporting the Arboretum and its program. Members receive Arboretum publications and enjoy other privileges, including notices of special field trips and lectures, and the use of the Arboretum facilities.

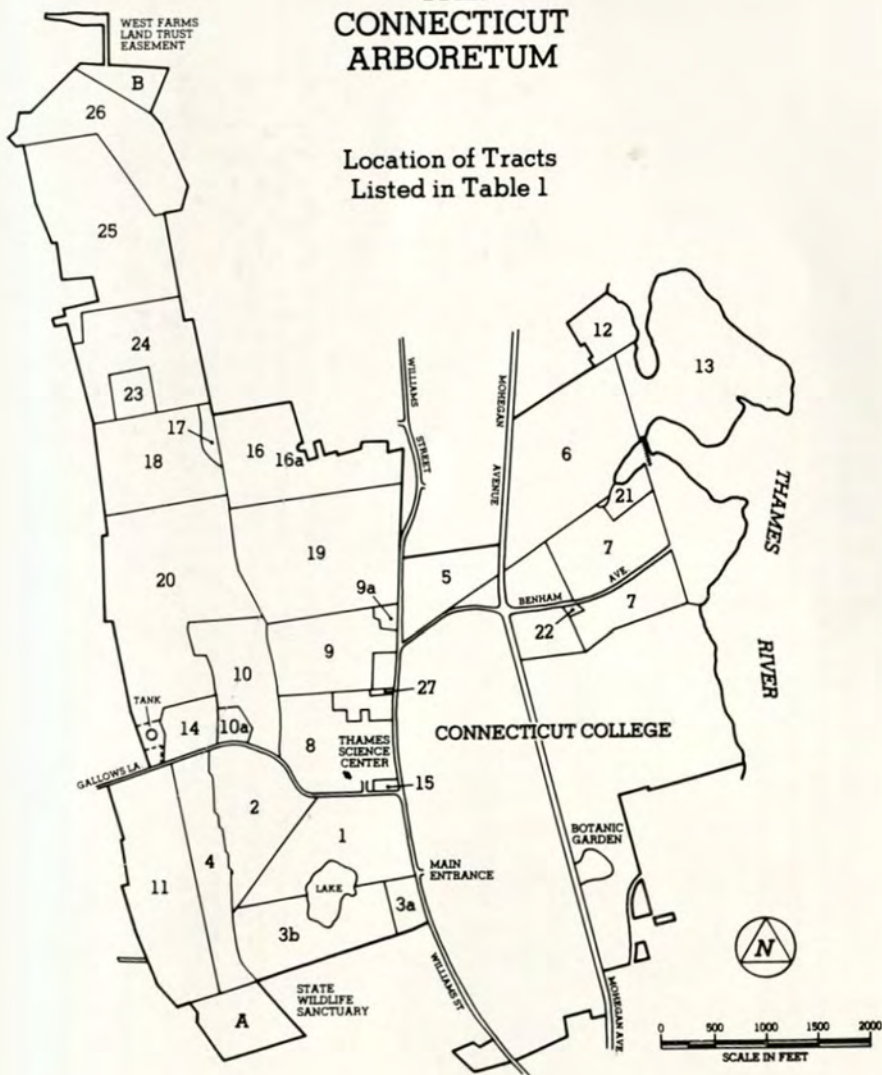
Individual memberships: annual, \$10; sustaining, \$25; life, \$500.

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Checks should be made payable to the Connecticut Arboretum and sent to the Director, Dr. William A. Niering, Connecticut College, New London, Conn. 06320.

THE CONNECTICUT ARBORETUM

Location of Tracts Listed in Table 1



THE CONNECTICUT ARBORETUM



AT CONNECTICUT COLLEGE
NEW LONDON, CONN.



LEGEND.

1. LAUREL WALK
2. OUTDOOR THEATER
3. BUCK LODGE
4. RED PINE GROVE
5. EDGERTON WILDFLOWER AREA
6. BOG
7. RED MAPLE SWAMP
8. RAVINE
9. OPEN LEDGE WITH GLACIAL ERRATIC
10. PICNIC AREAS
11. UTILITY RIGHT-OF-WAY DEMONSTRATION AREAS
12. COLLEGE RIDING STABLE
13. LANDSCAPING WITH HERBICIDES DEMONSTRATION AREAS
14. TIDAL MARSH
15. ARBORETUM FIELD
16. CAROLINE BLACK BOTANIC GARDEN
17. NEW LONDON HALL - MATTHEWS BOTANICAL LAB & GREENHOUSE
18. FANNING HALL - ADMINISTRATION
19. PALMER AUDITORIUM
20. THAMES SCIENCE CENTER
21. STENDEL WILDFLOWER AREA
22. WEST FARMS LAND TRUST EASEMENT



SCALE 1 INCH = 650 FEET



THE CONNECTICUT ARBORETUM
CONNECTICUT COLLEGE

Allen Corbett 1939

THE TREE AND SHRUB COLLECTION.