Frontiers
of PLANT SCIENCE

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THE SUBURBAN FOREST
A Modern Frontier of Research

The Suburban Forest: We are not alone
. . . *See Page 5*

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION • NEW HAVEN

As the pattern of land use in Connecticut has changed, so has our attitude toward the woodlands. A few centuries ago Connecticut was a forest. That forest was both an asset and an annoyance when colonists undertook a new way of life in a new land. Now our industry is so extensive, our agriculture so specialized, our way of life so dependent on the automobile, and our people so numerous that our woodlands may be considered a new kind of asset . . . the suburban forest. As more of us come to live in or near the suburban forest itself we find a greater need for knowledge of our surroundings. The soil and the water, the plants and the animals, are an established community and man is the newcomer. The newcomer is a disturber, he is also curious. He has found that intelligent curiosity, directed along the orderly lines of science, makes living more pleasant and more productive. Some things Connecticut Agricultural Experiment Station scientists have learned about the suburban forest, some they seek to know; these are the subjects of which we write in this symposium. We take first a comprehensive view of our woodlands, past and present, to see what the suburban forest is and how it got that way. Our guide is Henry W. Hicock, a Station staff member for 40 years, presently head of the Department of Forestry.

The SUBURBAN FOREST

Henry W. Hicock

The environment which we have called the suburban forest is highly complex: science calls it an ecosystem. It includes the atmosphere above, the soil and its underlying rock structure, water, plants and animals ranging in size from microscopic bacteria to ancient oak trees, homes and industrial plants, transportation and communication facilities, and finally people, who have vastly changed the system and in turn have been greatly influenced and benefited by it. Each facet or aspect of this system is in some manner or degree dependent on all other facets and none can be fully understood except in the context of all the others.

In pre-colonial times the Indians practiced a crude agriculture along the coast and larger streams but the total area was never large; they also frequently burned the understory over considerable areas of woodland for protection and to improve hunting conditions. In early colonial times forests covered 95 per cent of Connecticut's 3 million acres. Many of the trees were of very large size and of great age; the total volume may have exceeded 100 billion board feet. This forest was continually changing in appearance and structure but these changes took place slowly except locally where wind or some other natural destructive agency created openings. In general plant and animal life were in balance with the physical environment.

With the coming of the white man conditions began to change rapidly. Open land was required to produce food and by 1860 some 2 million acres had been deforested. Wood was needed for fuel, for construction, for local industries operated in connection with a rural economy, and for export. Some of this was obtained during land clearance, the balance by exploitation of the land still remaining under forest cover.

By about 1850 agriculture began to wane and concurrently industry began to expand. The net result over the past 100 years has been an almost complete switch from a rural to a manufacturing economy until now Connecticut is one of the most highly industrialized states in the country. During this period many changes have taken place.

Population has increased to about 2⅓ million souls who require vast amounts of water, food, transportation, other goods and services, and space for living and recreation.

One million acres once used for agricultural pursuits have been abandoned and are now again clothed with woodland growth. Abandoned farm lands are a problem unto themselves. Many of them have seeded in to species of little or no commercial value and many individuals of better species are open grown, worthless for saw timber. Often the underlying soil has excellent potential for timber growth, even though severely depleted of organic matter by agricultural cropping.

With the rise in industry, very large amounts of wood were needed for construction and for fuel. The demand was so great that many stands were clear cut, sometimes repeatedly, on short rotations. Such treatment cannot keep a forest in good silvicultural condition over a long period. Ideally there should be a balanced representation of age classes in the forest of trees from 1 to 100 or more years of age. As a result of over-cutting and short rotations more than 75 per cent of the stands are less than 40 years old.

Fires, often of great intensity, frequently followed cutting, destroying much young growth and depleting the humus supply. In addition they eliminated conifers and coniferous seed trees over large areas. These were replaced largely by hardwoods which sprout readily whereas the conifers can reproduce only by seed.

Insects and disease have taken their toll of woodland products and have had collateral effects tending to make the forest as a whole less resistant to attacks by pests. The most conspicuous example is, of course, the chestnut blight which not only eliminated the native chestnut as a commercial species but also completely upset the normal balance between this species and its associates.

The combined effect of land clearance and abandonment, unwise cutting practices, fire, and insects and disease have reduced our once vast heritage to a mere shadow of its former stature. The total timber volume is less than 5 billion board feet, soil humus has been depleted or changed; species composition is not sufficiently diversified to offer reasonable protection against catastrophic damage by pests.

Meanwhile, the pattern of use of the forest has changed markedly over the years. Until fairly recent times woodland was of primary concern to the owner as a source of income; under present conditions it is the concern of everyone. One very important role is conserving water for domestic and industrial use, and for irrigation; it is important also in the control of soil erosion on steep slopes; it is indispensable in the conservation of native animals and fish and for recreational areas where people can temporarily escape the stresses of life geared to a fast tempo. Lastly we should not overlook the possibility of forest land as a productive asset.

Even in their present condition the woodlands are serving us quite well in many ways. Can they do it for a population of 3½ million which is predicted for 1975? The answer is not at hand. It seems inevitable, however, that we shall need all the knowledge we can gain on how to make this large and complex system of maximum use.

Basic to most productive use of our natural resources is research on soils. Research on soils at this Station has been fruitful: it has helped immeasurably in intelligent use of fertilizer and lime on cropland, it has given us a better idea of how our soils may best be used. Before we consider in greater detail the plants and animals of the suburban forest, we hear from W. L. Slate and Paul E. Waggoner, who consider soils, suburbs, and scientists. Mr. Slate is director emeritus of the Station. Dr. Waggoner is head of the Department of Soils and Climatology.

Soils, Suburbs and Scientists

W. L. Slate and Paul E. Waggoner

Thirty-five years ago the Station began to intensify its research on Connecticut soils. It had always been a soil-plant science "Research Institute," but the research on soils had dealt chiefly with soil fertility in relation to crop production. This phase was continued and one notable product was the well known Morgan System of Soil Tests.

In 1923, when we undertook a thorough study, our knowledge of Connecticut soils was somewhat limited. True, the first American soil survey was made in the Connecticut Valley in 1899, and another in Windham County in 1912, but without the benefit of later advances in soil science.

Though the Station had embarked on research in forestry in 1900, little attention was given to the relation of soils to forests. In 1926 the Station began a study of the relation of forest composition and growth to soil characteristics. This was followed by studies of the use of fertilizers in coniferous nurseries, forest lysimeter studies under hardwoods, a generalized survey of the forest soils of Connecticut, and many others. These have been important contributions.

We are, however, living in a period of rapidly changing conditions. Current agricultural practice is yielding more on fewer acres; tobacco acreage may have to be radically reduced to conform to innovations in the cigar industry; considerable farming is being done on land which is inherently too poor to support good crops and, vice versa, many acres of potentially good farm land have been allowed to revert to tree growth; floods in recent years have demonstrated that many of our cities are unwisely located relative to topography and drainage; an excellent road system makes it possible for workers to live many miles from where they work but this often creates sanitation and other problems; an increasing urban population is more and more dependent on the suburban forest for water, recreation, and enjoyment.

Up to the present we have, in a sense, "drifted along," learning the hard way by allowing events to take their course. With a population increase of some 55 per cent predicted during the next 20 years, it seems inevitable that we must use the suburban forest and all other resources more carefully. Basic to any planning is a thorough knowledge of the soil, its properties, potentiality, and limitations. The soil survey of Hartford County, recently completed by the Station in cooperation with Federal agencies, provides much of the information needed for intelligent land use planning. Extension of this survey over the rest of the state is planned and when completed will place the entire suburban forest in better perspective and do much to aid in its development for maximum use.

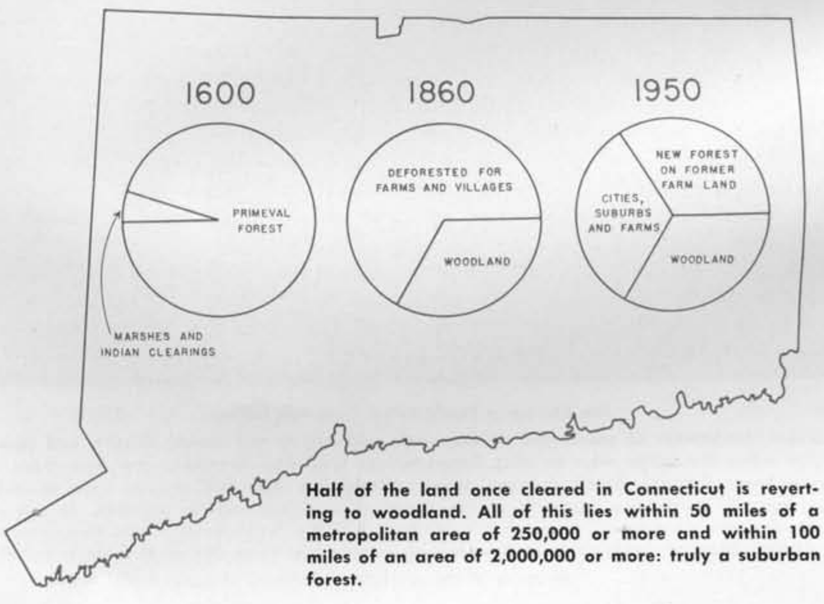
An analysis of land use in two towns now surveyed demonstrates clearly how the suburban forest has grown: as a cover for land not wanted for other purposes. In the table are given the percentages of upland and of the level, less stony terrace soils used for urban purposes, for cropland, and for forest. Clearly the trees have been relegated to the land no one else wants.

Percentages of upland and of terrace soils in Plainville and Southington used for urban development, for cropland, and for forest, 1952.

	Upland	Terrace
Urban	3	20
Cropland	14	27
Forest	71	35

Of course, this is not the land in which the most rapid tree growth occurs. Tree nurseries show what happens when economic returns are sufficient. Here, trees are being grown not where they are needed to cover wasteland but where they will quickly produce a root system satisfactory for transplanting. Nurseries are largely confined to terrace soils, the same soils that are desirable for urban development and cash crops. These soils are easily tilled, warm up early in the spring, and are well drained; all characteristics needed for easy production of well-rooted stock.

Thus we see how trees respond to differences in soil. But we shall not see the time when trees are grown where they will prosper most; they will be grown where nothing else is wanted. Therefore, the task ahead of the forester, soil scientist, and climatologist is to learn what kinds of trees will give the maximum return in beauty, conservation, and money on each site left for forestry and to devise inexpensive modifications of the soil and "microclimate" that will make them more favorable for suburban forests.



Half of the land once cleared in Connecticut is reverting to woodland. All of this lies within 50 miles of a metropolitan area of 250,000 or more and within 100 miles of an area of 2,000,000 or more: truly a suburban forest.

Putting together a picture of the suburban forest is much more difficult than assembling a complex jig-saw puzzle. We deal with life and death, with time as well as space, and with little-understood mysteries of the woodland. Researchers in many lines contribute to our understanding. Their findings must finally be evaluated in relation to all that others have learned. To seek out and describe how nature weaves living and non-living things into an organized natural system: this is a challenge to the ecologist, a scientist who studies all of the mutual relations between organisms and their homes. Dr. Jerry S. Olson, a forest ecologist, outlines some of these relations in the suburban forest.

A Forest is More Than Trees

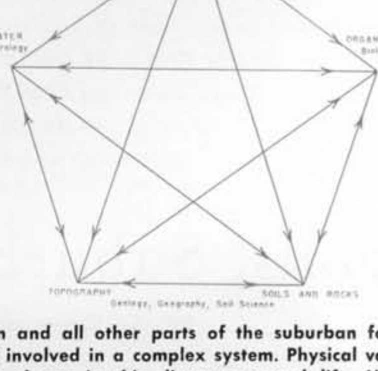
Jerry S. Olson

"No man is an island." Neither man nor any other part of the suburban forest is free from the other parts of this complex system. Topography and substratum, water, air, and the whole array of plants and animals are tied together in an intricate web.

The arrows in the accompanying diagram illustrate that many relations between parts of the suburban forest work both ways: the hardness of the rocks forming the backbone of our Connecticut landscape has outlined the gross differences between the highlands and lowlands; in turn topographic relief is a major cause of differences in the soil mantle overlying the rock structure. Topography controls the flow of water but our recent floods witness the capacity of water to change the topography. Groundwater determines the types of soil profile developed, and the resulting soil stores water that is needed for life.

Rain, snow, and ice from the atmosphere are the ultimate sources of water which sculptured the landscape. They are responsible for gross climatic differences; in turn local topography and moisture are responsible for important small-scale variations in air temperature and humidity which affect such diverse organisms as mosquitoes, caterpillars, tree seedlings, and picknickers. Soil properties also influence the microclimate of the air just above the ground and in turn are affected by this climate.

All these physical variables control life, by providing the right kind of place to live and minerals, moisture, and carbon dioxide by which the plants make food, wood, and fiber. But plants use only a small fraction of the sun's energy. Most of this energy is used to change the temperature of soil, air, and plants and in evaporating water: but the resulting effects on microclimate determine where and when plants and animals can grow.

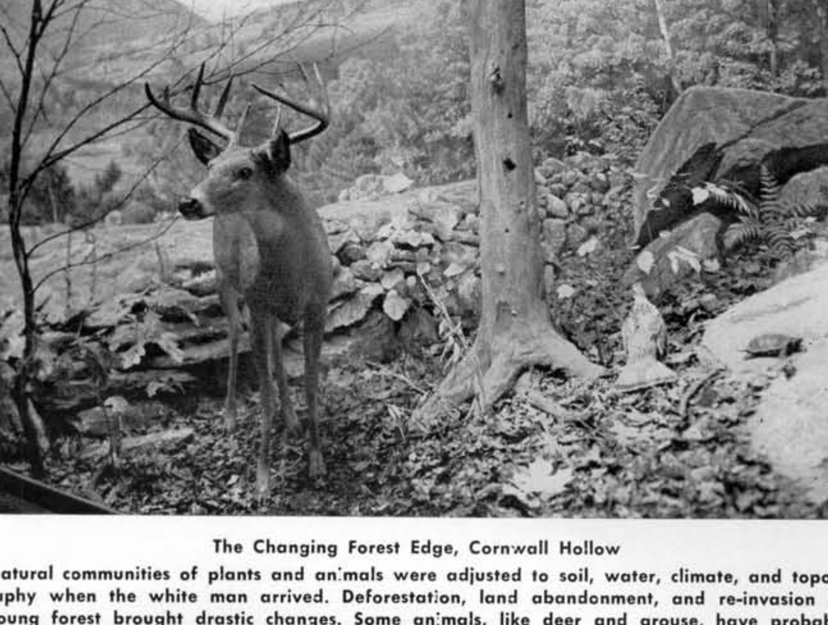


Man and all other parts of the suburban forest are involved in a complex system. Physical variables shown in this diagram control life. Living things, in turn, have their effects on their environment. Arrows indicate that interrelations work both ways.

Looking at it the other way, organisms play an active role in modifying their physical environment. Plants filter the sunlight, transpire vast quantities of water, contribute organic matter to the soil, and help protect the landscape from undue erosion.

Man's bulldozers excepted, animals modify the landscape mostly by modifying the plants. The gypsy moth caterpillar defoliates the forest canopy and thereby changes the microclimate and upsets the nutritional food chain involving plants and many other animals. The forester carefully makes thinnings to avoid excessive crowding and encourage a new generation of the desired kinds of trees; he may plant trees where a seed source or conditions favorable to the establishment of a new stand are lacking.

As one concrete example of this interdependence, let us trace briefly a few of the environmental relations of eastern hemlock, a graceful evergreen which is becoming increasingly abundant in Connecticut's predominantly deciduous woodlands. Man's history of cutting and fire eliminated hemlock seed trees over vast acreages. Now that fire is better controlled seed borne by the wind is slowly extending the species into areas near parent trees that escaped destruction—mostly on the lee side of the prevailing westerly winds. Nature's method is effective but slow and we need to know how to introduce the species with a good expectancy of success into areas where seed trees are lacking. Experiments under closely controlled conditions are providing data on genetic variation of hemlock and light and temperature conditions under which it



The Changing Forest Edge, Cornwall Hollow

Natural communities of plants and animals were adjusted to soil, water, climate, and topography when the white man arrived. Deforestation, land abandonment, and re-invasion by young forest brought drastic changes. Some animals, like deer and grouse, have probably been favored by brushy regrowth at the forest edge. Other animals perished. So did the chestnut (center foreground) when man unwittingly brought in the fatal blight. What changes lie ahead? Research helps us learn how woodlands can best serve our needs in years to come.

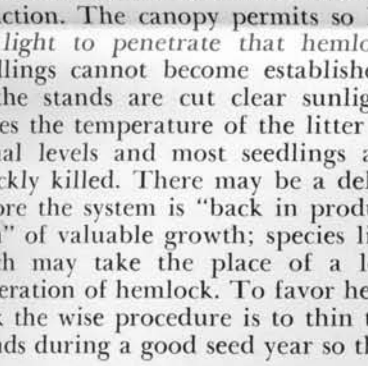
Diorama photo courtesy of Peabody Museum, Yale University

may or may not be expected to grow. These results have already helped clear up some of the nurserymen's longstanding difficulties in seed testing, germination, and dormancy.

Field observations and experiments relate the laboratory findings to natural factors of topography, soil, moisture, and weather conditions and provide a sound basis for understanding and managing the natural development of our forests.

Once hemlock is established in a deciduous forest it can survive shading longer than most other trees. Hemlock uses the light that is left over after the deciduous canopy has caught what it needs. We suspect that a mixed forest of hardwoods over groups of hemlock utilizes available energy and nutrients more fully than most stands which are wholly deciduous or wholly coniferous. This mixed forest may be among the earth's most efficient "crops" for converting the sun's energy into organic material. Wisely managed such a mixed forest is a system which runs itself with less intensive care and expense than agricultural crops and artificial forest plantations—and with low risk of total destruction by disease and insects.

Dense old hemlock stands, however, contain the elements of their own destruction. The canopy permits so little light to penetrate that hemlock seedlings cannot become established. If the stands are cut clear sunlight raises the temperature of the litter to lethal levels and most seedlings are quickly killed. There may be a delay before the system is "back in production" of valuable growth; species like birch may take the place of a lost generation of hemlock. To favor hemlock the wise procedure is to thin the stands during a good seed year so that seedlings can get started under partial shade. When they are well rooted and shading the soil with their own foliage the remaining older trees can be removed.



Spread of hemlock into the hardwood forest.

● 1800: Parent hemlocks long established.

1900: Hemlocks of seed-bearing age.

○ 1955: Hemlocks have spread to larger area.

→ Prevailing winds effective in seed spread.

The practical results of research help our efforts to keep the forests productive. The discovery of how the forest system "works" helps us and our children appreciate the significance of the woodlands we preserve to enjoy. Finally our thoughts on the complexity of the woods remind us of more far-reaching lessons: that mankind's welfare is bound inescapably to the integrity of the web of relations which nature has woven into a balanced and organized system; that many kinds of research are needed to show how the threads intertwine; and finally that, when man slashes into the web blindly, the unbalance in nature's system may literally bring unexpected troubles to his own front door.

Bob Wallis is a scientist you may encounter in the suburban forest as he seeks to learn more about mosquitoes and caterpillars, song birds, viruses, and vectors. His strong right arm often serves as a mosquito lunch counter, his research reports appear largely in respected scientific journals. He writes here of the sometimes spirited conflict that arises when we decide to live where the insects have long had things pretty much their own way. His research seems to show that nature will take its own course, but we can in some measure direct that course. And we have to live with it. Dr. Robert C. Wallis, medical entomologist:

Insects, Birds and Man

Robert C. Wallis

The living world of the woodland helps to shape the "insect problem" as we know it in Connecticut. The environment we call the suburban forest brings us face to face with woodland species of mosquitoes which we previously encountered only occasionally when we ventured into the forest.

So many of us have now moved into the natural habitat of mosquitoes that our presence there influences the population of these pests. More and more houses in the woodland setting mean more and more artificial breeding places for mosquitoes—cisterns, fish pools, and trash cans—a combination suited to increasing mosquito populations around the woodland homesites.

Many of these mosquitoes are capable of transmitting a virus disease, and therefore have been the subject of intensive study. One of these diseases is eastern equine encephalomyelitis, or "eastern sleeping sickness." This disease has appeared recently among people in Southern Massachusetts. Fortunately in Connecticut only horses and pheasants have been affected. Inasmuch as the virus which causes the disease is carried in wild birds and can be transmitted by mosquitoes, all factors which affect mosquito populations must be considered.

One of these factors is the trend toward a suburban forest. Two-thirds of our State is covered with woodland, an area which provides extensive harborage for wild birds carrying the virus. With carriers so widely dispersed, sources of infection may not be sufficiently concentrated for transmission of the disease to man. The infected vector population is not large enough in any one place to create a serious health hazard in the Connecticut suburban forest. However, it is large enough to pose an agricultural and wildlife problem.

The increase in our forest area also probably explains the striking shift in the types of mosquitoes present in Connecticut. Prior to the turn of the century, when the forest area was less extensive, published reports and records reveal the predominance of mosquitoes different from those we have today. Then the major pest species were those which breed in open sunlit floodwater pools and in open salt marsh areas along the seashore. These species no longer dominate the mosquito population. As the cleared areas returned to woodland, the mosquito species which prefer shaded woodland breeding sites increased, so that today they far outnumber the species which were once the major pests.

Forest ecology has important effects on the course of another virus disease, one which kills the larvae of the gypsy moth, a forest pest. Our recent investigations have shown that high relative humidity is involved in the appearance of this "wilt disease" virus. Under humid conditions the gypsy moth larvae are destroyed in great numbers by the onset of this disease. When the weather is extremely dry,

Many insects choose to live in the same wooded areas selected as homesites for our increasing population. How to get along with these insects is a continuing study for scientists.

however, and especially on high, rocky ridges and sandy plains, the gypsy moth larvae remain healthy and vigorous. Apparently they eat leaves to obtain water as well as food. When this occurs, defoliation is much greater than would otherwise be expected, trees are stripped of their leaves, and the hills stand stark.

In the past, when this severe defoliation by the gypsy moth occurred in the remote woodland, it did not affect us personally. We may have noticed this action-at-a-distance on a Sunday drive and that was about all.

Now, in our suburban forest, the caterpillars are right in our own backyards. Sometimes they crawl on the clotheslines, into the houses, and fall on the children playing outdoors. The caterpillar pests eat away the leaves, the shade from the hot summer sun disappears early in the season, and even the birds which normally grace the suburban neighborhood leave for a greener and presumably happier home.

Because mosquitoes and caterpillars are at our back door and vitally affect our welfare and happiness, much research is being carried on to gain a better understanding of the biology of these insects and the problems they present.

We have invaded the habitat of the insect and our way of life is changing the age-old ecological patterns. New problems arise. We can cope with these problems intelligently only if we understand the insects and their ways.

The geneticist confronts one of the many challenging frontiers of plant science. Basic research in genetics made possible the modern miracle of hybrid corn. One of the leaders among the scientists responsible for this revolutionary change in American agriculture is Donald F. Jones, head of the Department of Genetics. Dr. Jones reports on another application of research in genetics to a different kind of plant breeding problem: the development of a new tree, a chestnut able to survive without damage from chestnut blight.

Breeding Better Trees

Donald F. Jones

The native American chestnut was once one of the dominant tree species in woodlands from Maine to Georgia and westward to the prairies. The burnished brown nuts, securely protected by spiny burrs until ripe, dropped at the first touch of frost in the fall and furnished food for man and beast. Many campfires were built under the spreading chestnut tree. The bark of this useful tree tanned the leather for shoes and harness. Chestnut poles still carry the wires that connect homes and offices, but the living trees have almost completely vanished from the woodlands.

This catastrophe was the result of inadvertently importing from Asia a fungus disease that did little damage to the chestnuts in its native land. Just as the white man's measles, small pox, and diphtheria decimated the red man in the new world (and made easier the transfer of this vast domain) so also did this plant disease from Asia upset the woodland ecology for decades still to come.

There is no known chemical or sanitary control for the chestnut blight disease. Even if possible it would be impracticable to vaccinate forest trees, so obviously the solution of this problem was to go to Asia for the chestnuts native to that region that had lived for generations with this fungus disease.

By 1910 when the disease was first identified in the New York Botanical Garden enough was known about heredity in plants to indicate that the disease resistance of one species could be transferred to related species, if they could be hybridized. This was done by Arthur H. Graves, now a consultant on our staff, then of the Brooklyn Botanic Garden. Crosses of Japanese and American, and later Chinese and American, species were successful. These crossbred seedlings grew rapidly. They had the same straight trunk reaching toward the sky as the American chestnut with leaves larger and greener than either parent. Many of these seedlings grew six to ten feet a year. For the first few years these hybrid trees were free from disease although infected and dying trees were standing nearby. But, alas, as soon as the new hybrids began to flower and produce nuts, blight lesions appeared on all trees and soon girdled them at the base. Before they died Graves took the sprouts that grew from the roots of these dying trees and inarched these stems into healthy bark above the diseased area. This prosthetic device gave the trees a new lease on life until the next generation of seedlings could be reared. By intercrossing and backcrossing the second generation produced a few trees that were more resistant to the disease than the first generation hybrid or the American parent. Later Graves was ably assisted by Hans Nienstaedt, a student of forest genetics from Denmark, who studied the disease and made many new selections.

These few disease-free trees were far from the giant timber tree that Graves wanted to restore. Along with the genes that gave the trees resistance to disease came other genes for low spreading growth, suitable for nut production but not for timber. Many of these disease-free trees succumbed to low winter temperatures.

Many generations of further crossing, recombination and testing for disease resistance and winter hardiness are needed before the return of the native chestnut can be announced, but trees of sufficient promise are now growing at The Connecticut Experiment Station farm, the Sleeping Giant plantation, and the state forests to show that the chestnut is on its way back.

From what has been learned from chestnuts and other tree breeding programs geneticists are prepared to apply this knowledge to other species to make hardier, faster growing trees for forest and woodland planting.

From the spreading chestnut trees, once mighty masters of Connecticut woodlands, we move on to the algae, plants so small and so un-plantlike that we may entirely overlook them as living elements in our streams and ponds. But when a lake turns green with algae we cannot overlook the consequences. Bruce C. Parker, a graduate student at Yale University and staff member of the Department of Plant Pathology and Botany, points out that algae are neither good nor bad. They are rather a group of plants to be lived with. The question behind his research on algae is "How best do we live with them?" Best, of course, from the standpoint of man, not the algae.

Algae: Friend or Foe?

Bruce C. Parker

The crystal-clear waters of the highland forests are not unknown in Connecticut, but of necessity many of our streams and lakes have been put to work. In the process some of them are constantly supplied with the nutrients needed for profuse growth of algae: plants that live in the water.

Algae are probably best known for the nuisances which are caused by relatively few species of this diverse group of plants. The hate for algae may be justified, for a number of Connecticut's most beautiful lakes are plagued by summer algal blooms which usually take the form of blue-green, oily scums or green filamentous nets of plant material. When algal blooms decay, they often produce musty, fishy, or garbage-like odors. At the same time they may consume so much oxygen from the water that fish suffocate.

In the main, algae are more beneficial than harmful. In fact, most algal nuisances would not arise were it not for large quantities of nutrient-rich sewage and industrial wastes which find their way into many of our rivers and lakes. The ability of algae to grow rapidly and consume nutrients shows its importance in the purification of polluted waters.

Algae are useful. They are the fundamental unit in the food chain of all fish. Algae have been used as food supplements for both humans and domestic animals. Lysine, an essential

(Continued on Page 8)

For our convenience, we draw lines on a map to show boundaries between town and city. But in Connecticut long ago many of the suburbs became larger in area than the "urbs" at their center and almost as densely populated. Just as people have staked out their claims in the suburban forest, so have trees maintained vigorous outposts in our cities. Albert E. Dimond brings this symposium to a close with his comments on the urban fringes of the suburban forest. Dr. Dimond is head of the Department of Plant Pathology and Botany.

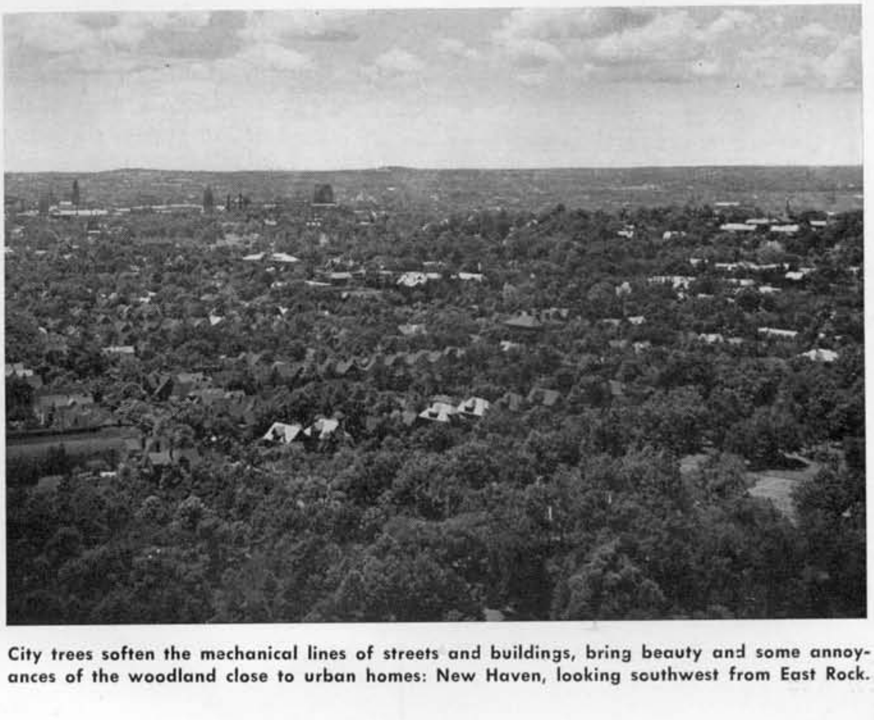
Our Trees Go to Town

A. E. Dimond

Trees in cities make up the urban forest. To overlook almost any Connecticut town is to be impressed with how forested our urban areas are. The suburban forest is molded primarily by climate and soil; the urban forest by our changing standard of living. In industrial towns, man alters the climate, and trees are subject to smoke and fumes, pavements drain water away and sidewalks and curbs hem in the tree and restrict and damage its roots. Wherever there are people, there are utility lines, delivering electricity and telephone service upon which man has become dependent. Man today will not tolerate outages in electric service and these result primarily from fallen limbs on wires.

These changes in our living pattern have changed the complexion of the urban forest. At one time city streets were lined with tall elms, oaks, and maples, which are symbols of grace and stateliness, but which, under the pressure of civilization, cannot be expected to grow in full vigor. Under crowded conditions, with inadequate water and little opportunity for fertilization, such trees become weakened and susceptible to disease and storm damage. In the future the function of the large tree is best served in parks and in ornamental plantings. This Station's research on controlling Dutch elm disease is designed to make present plantings survive. This research and that on breeding blight-resistant chestnuts are designed to make possible future plantings of two trees that are a traditional part of the New England scene.

Along city streets, the modern trend is to plant smaller ornamental trees. Varieties are now available that grow in a variety of shapes, that provide decoration without dominance. Experience has shown that such plantings are economical to maintain and are easily protected against pests. They also interfere minimally with the delivery of electric services to the home owner. Now more than ever before it is desirable to study new plantings carefully to provide graciousness, while being compatible with modern civilization.



City trees soften the mechanical lines of streets and buildings, bring beauty and some annoyances of the woodland close to urban homes: New Haven, looking southwest from East Rock.

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Editor, BRUCE B. MINER

ALGAE: FRIEND OR FOE?

(Continued from Page 7)

amino acid lacking in cereal grains, is obtained from *Chlorella pyrenoidosa* and used to enrich bread. Large marine algae are harvested for agar, the complex carbohydrate used widely for nearly everything from a stabilizer in ice cream to a medium base for culturing microorganisms. Marine algae are used also as a source of alginic acid for the textile industry and iodine for medication. Many algae are useful for fertilizer, and it is probable that, in the future, useful antibiotic substances, such as Chlorellin from *Chlorella vulgaris*, may be discovered.

Indeed algae are man's best friends as long as algae do not multiply to such an extent that they produce nuisance blooms. But then, in Seneca's words, "Everything that exceeds the bounds of moderation has an unstable foundation." Research can help us find ways to keep algae within the bounds of moderation.

New Publications

The publications listed below are now available, without charge unless otherwise indicated, to those who apply for single copies to Publications, The Connecticut Agricultural Experiment Station, Box 1106, New Haven 4, Connecticut.

Insect Pests and Plant Diseases

- B 600 Plant Pest Handbook. $1.
- C 202 The Iris Borer and Its Control
- B 601 Mineral Balance as Related to Occurrence of Baldwin Spot in Connecticut

Reports on Inspections

- B 602 Food and Drug Products, 1954
- B 603 Commercial Fertilizers, 1956

From the Director

In this issue of FRONTIERS we pull together our researches on trees. We do this because nearly every citizen is interested in trees. An occasional vandal will destroy a tree and the occasional exhibitionist will disfigure a tree by carving his inconsequential name.

Most people, though, hold trees in deep respect. I have stood among the giant Sequoias in Muir Wood and have watched load after load of chattering tourists disgorge from their buses. As soon as the woods close around them, as soon as they look up at a tree that has stood off its enemies for 3000 years, they stop their chatter and walk silent and subdued along the trails.

Interest in trees is everywhere. States have their state trees, and they set aside Arbor Day each spring. New Haven calls itself the Elm City, and Connecticut is very deeply proud of its Charter Oak tradition.

We here at the Experiment Station participate in this wide and pervading interest in trees. Perhaps our commonest query deals with tree troubles and inevitably ends with the remark, "I would hate to lose that tree!"

As pests and diseases of trees have swept across the State we have done our bit to learn to deal with them. In the last century it was the gypsy moth, then the elm leaf beetle, the pine blister rust, chestnut blight, and Dutch elm disease. In the meantime and all the time we have dealt with Verticillium wilt and bleeding canker on maple, pine shoot moth and weevil, fire and lightning. The list of our interests would be endless: charcoal, wood preservation, reforestation, conservation.

We conduct our researches on trees in almost all of our departments as will be seen from the articles in this issue of FRONTIERS. We have on our staff specialists in soils, chemistry, physiology, plant breeding, entomology, ecology, diseases, and several other fields. By so organizing the Experiment Station we hope to have on hand a person who can handle any research problem that may arise in trees or elsewhere.

Just now the gypsy moth is on the rise in the state. The simplest control method is to squirt the trees with DDT from an airplane. This method finds favor with those whose trees are being killed or whose houses are being invaded by caterpillars. Others who are interested in fish, game, wildlife, or organic gardening are not so happy. Thus, we search for a better way.

The final solution to the gypsy moth problem will be difficult, but we hope that collectively we can bring to bear enough talent to solve it. The study on the basic ecology of the hemlock may help, because it may enable landholders to renew the susceptible forest with resistant hemlock and thus "Keep Connecticut Green."

James G. Horsfall

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