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Our Heritage of Community Trees

Henry D. Gerhold
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Cover: *Penn's Treaty with the Indians,* oil painting by Benjamin West, 1771-72, courtesy of the Pennsylvania Academy of the Fine Arts, Philadelphia. Gift of Mrs. Sarah Harrison (The Joseph Harrison, Jr. Collection).

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Our Heritage of Community Trees

Trees are features in landscapes which extend far beyond property lines. They belong in a sense to the entire population. They are our shade trees rather than exclusively your or my shade trees. They are heritages of a succeeding generation, as well as our own. They are material assets of private property, and at the same time contribute substantially to the well-being of the community, the state and the nation.

- EPHRAIM PORTER FELT, 1938

Chapter 1.

Introduction

Trees beautify many of our towns and cities and enrich our lives in various ways. Most of us admire and enjoy these trees that we encounter every day, but we largely take them for granted. Yet the heritage of landscape trees in our communities has a fascinating history, one that can deepen our appreciation of the trees and the people who take care of them.

Have you ever wondered, as you looked at a tree-lined street, about questions such as these?

- When, where, and why did the idea of planting trees along streets get started?
- Are there special kinds of trees that can tolerate urban conditions, how were they developed, and where did they originate?
- How did people learn about the best ways to plant and care for landscape trees?
- Do most communities manage their trees properly, and how do they organize this work?

If you find these kinds of questions intriguing, read on, for you may be surprised by the answers.

Only recently have experts fully understood the many benefits of landscape trees, and how communities can care for them and keep them healthy in stressful urban envi-

ronments. This field of knowledge, now known as *urban forestry* in North America and in other parts of the world, has gradually emerged mainly from the disciplines of arboriculture, landscape architecture, and forestry, and includes subjects such as horticulture, soil science, plant pathology, entomology, and social sciences.

To explore the roots of urban forestry we consulted American and European literature that illuminates the history of how trees came to be planted and cared for in towns and cities. References are listed in the final pages for those who want more details. We focused on European-American relationships because that is how urban forestry originated. Some elements of urban forestry can be traced to European origins and more distant places, whereas others are distinctively American. Obviously trees also have signifi-

Were street trees "invented" in Europe or America? Tewksbury, England, and many other European cities still have few trees downtown.
Photo by Henry D. Gerhold.

cance in many other ways to people throughout the world, but that is another story.

Before delving into the origins and development of urban forestry, let's consider what urban forests are and why landscape trees are important to people.

WHAT IS AN URBAN FOREST?

The very idea of an *urban forest* at first seemed strange, even contradictory, when this term was invented. But it has become accepted and even commonplace. *Community forest* and *city green* are related terms with similar meanings. All three refer to the trees, lower vegetation, open green spaces, and associated wildlife within a municipality or adjacent to it.

The term "urban forestry" was coined in 1965 by Professor Erik Jorgensen at the University of Toronto. This unusual juxtaposition of "urban" and "forestry" arose in searching for an appropriate title of a graduate student's thesis. Jorgensen gave this scholarly definition of urban forestry: "a specialized branch of forestry (that) has as its objective the cultivation and management of trees for their present and potential contributions to the physiological, sociological, and economic well-being of urban society". Furthermore, he believed urban forestry does not deal only "with the city trees or with single tree management, but rather with the tree management in the entire area influenced by the urban population". The managerial concept of tree populations in the context of community interests is more comprehensive than arboriculture, which focuses on the care of individual trees. It was in the United States that urban forestry first took root and developed into a national movement.

In traditional forestry trees are managed for timber harvests and to provide other goods and services. Whereas in urban forestry trees are cultivated mainly for their aesthetic and environmental qualities, to be "harvested" only when they die or become hazardous. A traditional type of forest set aside for the good of a community sometimes is referred to as a "community forest", and may be considered a part of the larger urban forest that also includes trees within the town. A community forest at Zurich, Switzerland, has provided timber, firewood, recreation, and watershed protection since 853 AD; the oldest community forest in America was established in 1640 at Newington, New Hampshire.

"Community forestry" sometimes is used as a synonym for urban forestry. That is because residents of towns and hamlets usually consider themselves rural, not urban, and think that urban forestry doesn't apply to them even though it is meant to be inclusive of all municipalities, regardless of size.

VALUES OF URBAN FORESTS

A well-managed urban forest has numerous advantages, ranging from aesthetic, economic, and health benefits of various kinds to favorable social and psychological influences. Some of these were recognized long ago. For example, a 1700 ordinance in Philadelphia directed that every owner of a house "should plant one or more trees before the door that the town may be well-shaded from the violence of the sun...and thereby be rendered more healthy". In 1792 the citizens of Philadelphia petitioned the mayor to plant trees in the public squares because "it is an established fact that trees and vegetation...contribute to...the

increased salubrity of the air". The New York City Commissioner of Health recommended in 1872 that street trees be planted to mitigate the intense heat and thereby diminish the death rate among children.

Recent studies have quantified other kinds of benefits: property values increased by landscaping, energy saved in heating and air conditioning of buildings due to the proper placement of trees, pollutants removed and carbon stored by urban forests, and even improvements in human health. Amazingly, hospitalized people recover faster when trees are in view.

Furthermore, urban forests that are aesthetically pleasing attract people and businesses to communities. Studies indicate that people have an innate desire to be close to the natural environment, and the urban forest can make this connection for people. Urban forests offer places for social gatherings, and can lead to a greater sense of community pride. The urban forest plays three main social roles according to H. W. Lawrence — a natural element in a humanized landscape, an aesthetic object in designed compositions, and an object expressing attributes of power such as ownership and accessibility.

Trees enhance the beauty and health of communities, attract shoppers, increase property values, and provide many other benefits.
Photo by Henry D. Gerhold

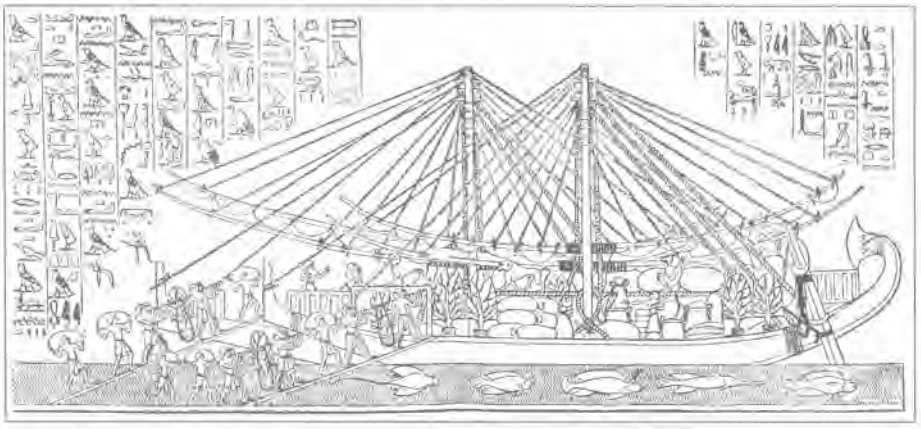
The values and purposes that people see in urban trees have changed over the centuries. Attitudes of people and trends in landscape architecture have been shaped by events such as the growth in populations, the Renaissance, the Industrial Revolution, the democratization of governments, the installation of utility wires and sewer systems, and the paving of streets and sidewalks. Cultural traditions of various ethnic groups also have affected views of trees in urban landscapes. For example, a Canadian study found that in Toronto people from a British background were most eager to have shade trees, Italian and Portuguese neighborhoods preferred fruit trees and vegetable gardens, and the Chinese least wanted trees on their properties. These kinds of influences will become more apparent as we examine historical developments in the next three chapters:

Chapter 2. Design of Urban Landscapes

Chapter 3. Arboricultural Practices

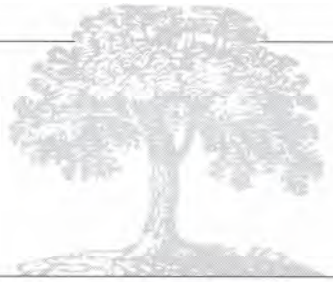
Chapter 4. Urban Forest Management

Saplings shipped from southeast Africa to Egypt about 1480 BC.
From Hennebo 1979, courtesy of Patzer Verlag, Berlin-Hannover, Germany.



Chapter 2.

Design of Urban Landscapes



Various ancient civilizations incorporated trees into their landscapes, but little is known about how that happened. Because these trees were transplanted and served specific purposes it follows that the plantings were designed, even long before there were professional landscape architects. The Hanging Gardens of Babylon during the 6th century BC have been cited as the first intentional use of vegetation in an urban setting. But even earlier, royal gardens in Egypt during 140o to 1362 BC had rows of sycamores, palms, and pomegranates; and Ramses III (1198-1167 BC) had trees planted, some along streets, for promenading and recreation. The Chinese, Greeks, Egyptians, Phoenicians, Persians, and Romans all held trees in high regard and even worshiped them. They used trees for aesthetic purposes in formal gardens, sacred groves, and landscapes that enhanced temples, statues, and buildings. In ancient Greece trees were planted in plazas to beautify cities, and for shade along pathways leading to marketplaces. Roadside trees enabled Romans to see the course of the road from a great distance, giving an advantage in military campaigns. Roman laws prescribed severe penalties for anyone who injured a tree.

TREES BECOME URBANIZED IN EUROPE

Changing property rights and relationships between people and trees in the Old World probably have some lingering influence today. Tribes that overran Europe regarded forests as communal property. But starting in the 7th century a series of kings, dukes, and barons laid claim to most lands and ruled through appointed rather than elected officials, thus reducing private property rights. City forests came into existence in the 10th century when kings gave land to the cities that emerged from the feudal system. In 1749 Prussia placed city forests under the provincial governments, and in 1754 charged foresters with supervising communal forests. After centuries of authoritarian control over communal forests, ordinary people today still have a sense of shared ownership but expect officials to look after the forests.

After the Dark Ages in Europe, say 500 AD, turbulent times caused people to move into fortified cities. Crowding inside the walls led to the demise of open garden areas and trees within the cities. Folksmeadows and festival places with trees were common outside the city gates, gathering places for all sorts of activities and celebrations. For example, a public meadow at Nuremberg purchased in 1434 had rows of lindens planted in 1443, and has remained in continuous use for more than 500 years. A few special purpose trees were planted near churches or in public squares as witnesses and durable reminders of agreements.

By the end of the Middle Ages, about 1500 AD, urban areas were well established but with few interior trees or greenspaces. Thereafter urban design began its long development from the formal gardens of the elite to public greenspaces and street trees, as thinking shifted from sur-

Medieval villages had hardly any space for street trees; Vaison-la-Romaine, France.
Photo by Henry D. Gerhold.

vival to aesthetics. Throughout the literature pertaining to urban trees in the Old World, there are indications that city officials ordained trees in cities, designers prepared plans for them, and skilled gardeners tended the trees; but the details and explanations are obscure or unrecorded.

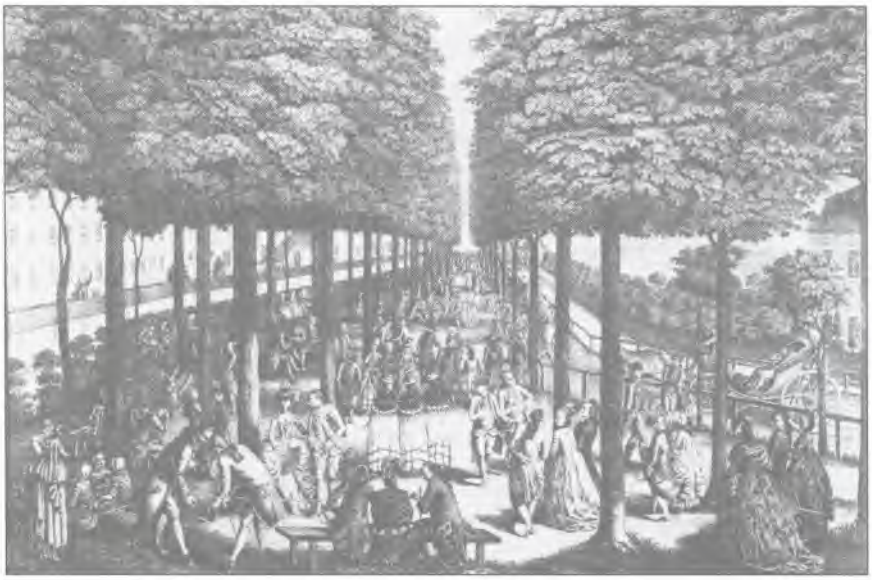
Already in 1486 the Italian city planner Leone Battista Alberti wrote about the design of cities, foreshadowing city greens and tree planting that would add beauty and recreational opportunities to the residences and ordinary necessities of life. Gardening activities gradually increased during the next century, mainly by the wealthy and powerful. Tree care practices such as pruning and pest control were employed at that time, for example a 1511 ordinance in Nuremberg required that tree-defoliating caterpillars had to be collected by certain deadlines. Some patricians of grand estates showed off their gardens and botanical collections to the public, such as the Villa Borghese in Rome and the estate of Gessner (1516-1565) in Zurich.

Early in the 16th century European cities had extensive forests outside their fortifications. So nature was always close by, but on land mainly used by nobility for hunting or to produce income during times of war. As cities expanded

more forests were cut for agricultural purposes, less space was available for outdoor recreation, and trespassing by common people caused the nobility to enclose their possessions.

The beginning of the Italian Renaissance in the 16th century, which later spread throughout Europe, brought with it the opportunity to "get back to nature". Garden design flourished under the direction of the nobility and the wealthy, and towns and cities encouraged the introduction of trees into the urban landscape. The first of several distinct landscape elements described by H. W. Lawrence appeared in Italy, the *garden allee*, a tree-lined pathway in a garden generally enclosed in walls. The French modified the Italian garden style by making the allee longer and more prominent. A notable example was the royal gardens of Tuileries, where upper class people would stroll and relax among the shady allées.

Wallpromenade in Leipzig, Germany in 1777.
From Hennebo 1979, courtesy of Patzer Verlag, Berlin-Hannover, Germany.



During the late 16th century military engineers constructed ramparts, earthworks, and ditches instead of masonry walls around cities in reacting to new weapons and siege tactics. These new types of fortifications became public open space in some cities. Double or quadruple rows of trees sometimes were planted, creating a new type of allée — the *wall promenade*. Early examples occurred in Antwerp, Amsterdam, Strasbourg, and Lucca. Promenades just outside cities were planted in the 18th century at Stuttgart, Heilbronn, and Vienna.

Closely related to the wall promenade was the *waterside promenade,* which appeared early in the 17th century in the Low Countries as waterborne commerce expanded in northwestern Europe. The primary example was the 1615 "Plan of Three Canals" in Amsterdam, where houses of the wealthy and rows of elms lined the canals. That was the first recorded use of buildings, traffic, and rows of trees together as a unified spatial form in a city interior, rather than in isolation as with allees and wall promenades.

Two new recreational pastimes arose in the 17th century that caused modifications of the garden allée. The game pallo a maglio originated in Italy with *malls* consisting of lawn areas and rows of trees to provide shade for spectators. This game resembling croquet became popular throughout western Europe, and many malls were installed near urban centers. In Paris a mall was built in 1599, Berlin built the forerunner of the famous Unter den Linden in 1647, and the Pall Mall in London existed before 1650. As the game went out of fashion, the malls were converted to other uses.

Another development, which also originated in Italy, was carriage riding for pleasure along *cours*. Marie de Medici introduced pleasure riding to France and in 1616

had the Cours de la Reine designed. The Cours resembled the name of a roadway outside of Florence, known as the Corso. The Cours de la Reine was open only by invitation and became popular with Parisian high society. Some other cours were accessible to anyone with a carriage. The malls and cours added a new dimension to the European landscapes — greenspaces that were part of the urban landscape outside garden walls or estates. Lawrence considered the cours very important "because it transformed the garden allee into a place for vehicles, albeit one not yet integrated into a city's street system".

The *exterior avenue* was the next landscape form to evolve at about the same time as the cours. Henry IV (1589-1610) had the thoroughfare Cours de Vincennes constructed, bordered by four rows of elms. By the late 17th century these avenues were built on the outskirts of urban areas as grand entryways to city gates or important buildings such as a hospital or a chateau. They often would form a large network of avenues, providing spatial organization. The Avenue des Tuileries is a prime French example, and exterior avenues also could be found elsewhere in northwestern Europe. As the cities grew in size, these tree-lined country roads became tree-lined city streets. The Paris example spread to other French cities, including Dijon in 1670, Montpelier in 1688, Nimes in 1730, and Toulouse in 1754. Elements of the Paris Greensystem installed under Louis XIV (1693-1715) were a precursor of similar installations in other European cities.

Open spaces at important intersections of avenues, called *places* in France, became an important part of urban design. The place was inspired by the 16th century Italian *piazza,* or *town square,* which typically was devoid of vegeta-

tion. Some early examples of tree planting in city plazas are Basel in 1572, Cologne in 1572, and Frankfurt in 1580. The French modified the place by the 18th century to include trees. The French places, the German *platzen,* and the Spanish *plazas* were usually open to vehicular traffic and integrated with structures as public amenity areas. In Britain most squares lacked trees before 1800, but by 1850 there were about 15 London Squares landscaped with trees and grass, surrounded by housing rather than shops and markets.

Usually trees were not introduced into the street system until cities expanded or new towns were designed. The French created a new landscape pattern, tree-lined *interior avenues,* by imitating the 1580 design of Piazza del Popolo in Rome and adding trees to three pathways radiating from a place. A well-known example is the design of Versailles by

Mannheim, Germany in 1782, showing trees along a street and in a platz.
From Hennebo 1979, courtesy of Patzer Verlag, Berlin-Hannover, Germany.

the celebrated gardener and architect André le Notre . This design in the 1670s transformed Louis XIV's chateau into a residential center with radiating tree-lined avenues and places. Le Mitre traveled to Italy, England, and other countries, where his style was adopted. The Versailles design was imitated in Germany when the 1673 enlargement of Berlin changed Unter den Linden into an interior avenue.

In the middle of the 18th century a change occurred to the interior avenue — its use as a through street instead of an entryway. French urban designers began to incorporate trees as principal features along streets in residential and commercial areas. According to E. H. Zube it was this formal, baroque style of design that was influential in 18th century town planning. Expansions of Toulouse and Lyon were examples of cities structured around networks of tree-lined streets. Still, the interior avenue remained primarily as a place promenade throughout the rest of the century.

The baroque *boulevard* is the individual form that contributed most to the 19th century boulevard, according to Lawrence. In 1670 Louis XIV ordered the destruction of walls around Paris because of confidence in his army. These areas were transformed into broad, elevated, tree-lined promenades that were open to carriages and pedestrians. Unlike other wall promenades, the new ramparts served no defensive function, and furnished a recreational zone at the edge of the city street system. Cours des Ramparts was the original name, but soon they were called les Boulevards and became more fashionable as the city expanded. The transformation of city walls from fortifications to promenades was not prevalent in most of Europe until after the Napoleonic wars in the early 1800s. Then many new tree-lined boulevards became an important element of the European urban landscape.

Amsterdam, Holland street scene about 1725.
From Hennebo 1979, courtesy of Patzer Verlag, Berlin-Hannover, Germany.

As the character of city streets changed, starting late in the 17th century, trees began to be planted along general use streets for shade and ornament rather than for recreational purposes. The old medieval streets that were rough, winding, dark, and narrow became more functional when they were widened, straightened, paved, and lighted. According to Dieter Hennebo, German publications of Willebrand during 1771 to 1776 gave recommendations for developing lovely cities, including shade tree planting along streets, in parks, and city greens. Trees were to be planted to beautify, improve health of people, and provide recreational opportunities.

During the Industrial Revolution the British developed and popularized several new features including sidewalks, storm drains, and house numbers, though trees were not

included in the street design. Although these street elements originated in England, it was in 19th century France where tree-lined boulevards took on the familiar modern characteristics. There the sidewalks provided safety for pedestrians and also greatly improved the planting areas for trees; they protected the soil from compaction and the trees from injury. The Avenue des Champs Elysees and the Grands Boulevards in Paris were the first examples of this new type of street. Napoleon III used the few tree-lined streets as examples in rebuilding Paris during his reign (1848-1870).

Why were trees desired along the new street designs, besides providing aesthetic and recreational amenities? Public perceptions of trees changed in the 19th century, as people came to realize that vegetation was important to a healthy city. Trees were expected to shade the widened sunny streets and were thought to assist in public sanitation by purifying the air of "miasmas", a presumed cause of disease. Napoleon III had another reason for planting trees along streets, for the convenience of troop movements through the city. Baron Georges Eugene Haussmann had wide, tree-lined boulevards cut through Paris in the 185os and 1860s, which were not residentially oriented. The broad boulevards doubled as parade grounds, and the trees could provide a defensive shield for the troops. Lawrence also regarded the tree-lined boulevards as a token effort by autocratic rulers to show generosity and civic commitment to the general public.

Remnants or modern versions of these original landscape designs still can be seen today in many European cities. This European heritage probably influenced the design of urban plantings in America to some extent, as we shall see.

URBAN TREES IN AMERICA

During colonial times in eastern America the settlers came mainly from towns and cities in England and northwestern Europe where trees were scarce, and were just becoming part of the designed urban landscape. The pioneers encountered vast, foreboding forests that had to be cleared for agriculture. Trees were useful, to be sure, as they provided building materials, fuel, and many kinds of wooden implements. Though landscape trees were not a main concern to settlers struggling to survive in the wilderness, trees were planted along streets and around the "common" pasture in nearly every New England hamlet.

Attitudes of America's founders no doubt had a role in shaping the urban landscapes that developed as settlements grew and a new nation was founded — attitudes about freedom, independence from European domination, and beliefs in private property and free enterprise.

How did trees come to be planted in colonial villages? Woodcut of Longmeadow, Massachusetts, about 1840.
Courtesy of Richard D. Schein.

Thus the architecture in the rebellious colonies was far removed from spatial dependence on Old World models. Consequently many of our public spaces developed differently, though some European influences were evident. For example, Bowling Green park on Manhattan Island dates almost from the time of a Dutch trading post in 1613, and outdoor bowling remained popular in many places until the 18th century. During the 1700s Dutch gardens in New York were full of topiary animals and birds, but when the English took over their gardening ideas replaced the Dutch influence.

Richard D. Schein has compiled a history of street trees in America, based upon writings of several authors, drawings and paintings, and his own deductions. He reasoned that as land was cleared for farms native trees were left along hedgerows and country lanes, and where these roads came into town they became tree-lined streets. That scenario is distinct from the evolution of avenues and boulevards in Europe.

Tree protection regulations were instituted early on so people or animals would not destroy the trees, for example in 1637 at Watertown, Massachusetts, at the Boston Common in 1661, and at Newark, New Jersey in 1676. Purposeful planting was begun before the time of the Revolution. The first public planting for the relief of travelers occurred in "Boston Towne" in 1646. One of these trees, the famous "Liberty Elm", served as a symbol of colonial defiance against the British.

A chronology of landscape trees in Philadelphia is revealing of early tree planting practices and attitudes toward trees. Starting in 1681, William Penn made plans for a "Greene Countrie Towne which will never be burnt and always be wholsome", with spaces for five large public

Trees were planted and protected as colonial villages grew. Woodcut of Woburn, Massachusetts, about 1840.
Courtesy of Richard D. Schein.

squares. Streets were named after trees in 1684, and the names remain today including Cedar, Chestnut, Mulberry, Pine, and Spruce. In 1700 an ordinance required owners of houses to plant trees, but the first organized planting of street trees did not take place until 1750. An act passed in 1782 sponsored by the Philadelphia Contributorship, the first fire insurance company that had been founded by Ben Franklin, required the removal of all trees in streets because they were believed to obstruct passages, interfere with watercourses, and spread fires. The act was repealed within five months because of strong objections by the public. In 1784 a second insurance company, later called appropriately "The Green Tree Company", catered to clients who had trees in front of their houses. By 1787 many trees had been planted, particularly Lombardy poplars and American elms. A 1788 editorial in the *Pennsylvania Evening Herald* proposed planting rows of trees

along Market Street to "contribute to the health of citizens, be ornamental, and furnish a refreshing shade for foot passengers, horsemen, and carriages". This recognition that trees confer health appeared here at least as early as in Europe, for Penn's "wholsome" predated European references that we found by more than 80 years. During 1793 to 1804 several European travelers noted streets with rows of trees on each side, especially Lombardy poplar. From 1817 to 1825 more than 6o varieties of trees were planted in Washington Square, and a few years later 43 native and 7 European varieties were added. Fairmount Park became an official public park by ordinance in 1855. In 1896 the city hired its first professional arborist, Chief Forester John C. Lewis; with this title and role, perhaps he could be called the first urban forester in America. Philadelphia had grown to be a large metropolis in the 18th century and was considered to be pre-eminent in horticulture, so its use of trees was not necessarily representative of other cities and smaller towns.

Some other American cities also designed trees into their landscapes early in their history, as illustrated by the following examples. In 1773 Oglethorpe planned Savannah, Georgia to have 26 squares for public use, and live oaks planted in long avenues were festooned with Spanish moss. On the western frontier, Sacramento was built around existing trees in order to preserve its natural beauty. Major Pierre L'Enfant's design for Washington DC in 1791 called for trees on both sides of the main avenues. Thomas Jefferson participated actively in L'Enfant's plan, having developed an abiding interest in landscape architecture in France and England. Woodcuts from about 1840 depicting Massachusetts villages show that trees had been planted purposefully and protected against livestock.

As our new nation expanded westward after the War of Independence, migrants patterned their new communities after their mental images of eastern villages and cities. Typically they were laid out around a central square containing a courthouse, and streets were arranged in a grid. In 1841 Andrew Jackson Downing, a nurseryman who educated himself to become America's first professional landscape architect, discussed principles for designing with trees. He suggested that villages should form an "Ornamental Tree Society" to "turn dusty lanes and bald highways into alleys and avenues of coolness and verdure". Some of the first village improvement associations, formed to advocate street trees, were founded at Northampton and Stockbridge, Massachusetts. By 1850 five states had ornamental tree societies; later these associations grew to over 1,000.

> *...how many towns, how many villages, could we name where rude and uncouth streets bask in the summer heat, and revel in the noontide glare, with scarcely a leaf to shelter or break the painful monotony! ... What must be done in such cases? There must be at least one right-feeling man in every such Sodom. Let him set vigorously at work, and if he cannot induce his neighbors to join him, he must not be disheartened — let him plant and cherish carefully a few trees, if only half a dozen. In a very few years... their luxuriant leafy arms, swaying and waving to and fro, will make more convincing gestures than any member of congress or stump speaker; and if there is any love of nature dormant in the dusty hearts of the villagers, we prophesy that in a very short time there will be such a general yearning after green trees, that the whole place will become a bower of freshness and verdure.*
>
> *— Andrew Jackson Downing, 184*7.

At about the same time states changed their fencing laws to require livestock owners to enclose their animals, whereas formerly it had been the responsibility of property owners to exclude livestock if they wished to protect their greenery. In the 187os many state legislatures passed laws to allow the planting of ornamental trees along right-of-ways. J. B. Jackson regarded the street with double rows of shade trees to be typical of small-town and rural America. Accordingly, state legislation, the spatial reorganization caused by fencing laws, and village improvement associations during 1850 to i goo resulted in landscape features that are intrinsically American. A prime example is the tree-lined street with spacious lawns sweeping back to buildings, unencumbered with walls or fences.

Jackson observed that the natural, picturesque school of landscape design that originated in Europe and gave a romantic feel for the environment was adopted widely after 1840. Ervin H. Zube concluded that the consequent change in attitudes resulted in an "American landscape (that) was beautiful because it reflected a social order that was free and egalitarian". In 1857 Frederick Law Olmsted and Calvert Vaux employed this naturalistic style to design New York's Central Park, which had been inspired by Downing's writings and authorized by the New York legislature in 1851. Olmsted and Vaux invented the name "landscape architect" in 1858 to convey their intent to design the landscape, just as an architect designs a building. Between 184o and 1900 cities were growing and changing rapidly, experiencing new transportation systems that enabled expansion into suburbs where the new landscape concepts could be applied.

Downing, Olmsted, Vaux, and other designers attempted to create landscapes that they believed would promote

Frederick Law Olmsted
John Singer Sargent, 1895, oil on canvas, Biltmore Estate, Asheville, NC.

social progress, such as greater tolerance and appreciation of diverse peoples. They revised gridiron designs commonly employed by real estate developers towards the concept of a new, naturalistic urban landscape that furnished more open space, parks, trees, and living conditions and thereby favored family values and a moral society. Landscape planning in cities was stimulated by the "City Beautiful" movement, promoted chiefly by the writings of Charles Mulford Robinson in 19o1 and 1903, the many lectures of" Horace McFarland who was a founding leader of the American Civic Association, and the designs of Daniel Hudson Burnham for Chicago, San Francisco, and other cities. The broad, tree-lined boulevards and public parks built in the loth century in several cities — Chicago, Detroit, Los Angeles, Minneapolis, San Francisco, St. Louis, and Washington — were modeled after those in Paris.

Industrial developments during the late 1800s and early 1 goos caused grave problems for street trees everywhere. Installation of utility wires, sewer systems, and pavements for roads and sidewalks grew at exponential rates. Branches were disfigured by pruning, roots were torn up by excavation, and leaves were injured by fumes, excessive heat, and inadequate moisture. These injurious forces threatened the health of existing trees and required greater attention to the choice of trees that could withstand urban stresses. To cope with these problems, states

passed laws that fostered municipal street tree ordinances and shade tree commissions that could preserve and manage their landscape vegetation in keeping with the desires of residents, as described in Chapter 4. Shade tree commissions thus were enabled to exert local control over tree planting, maintenance, and the choice of species.

CHOICE OF TREE SPECIES IN LANDSCAPE DESIGN

Choosing appropriate species is a crucial part of landscape design and also a vital part of arboriculture, so it is woven into the narrative at this point. Species characteristics must be matched to site conditions so that the trees complement their surroundings and remain healthy. And there are so many species among which to choose!

Seagoing explorers and "discovery of the New World" initiated an age of plant exploration and exchange that greatly enriched American and European landscapes. But

Lombardy poplars, still popular in Europe, are seldom planted in America now because of disease problems.
Photo by Henry D. Gerhold.

according to H-L Li, "plant dispersion and introduction has been carried on through all ages and in all countries". The first record of foreign plant introduction was into Egypt in 1570 BC. Chinese writings note that in 481 BC disciples of Confucius planted trees from their native regions near and far as memorials at his grave. Though records before the 16th century were scarce, Li believes plant dispersion then was done mainly by merchants, adventurers, and pilgrims.

One of the earliest plant explorers of the New World was John Tradescant II. He sailed for Virginia three times between 1637 and 1654, and returned to England with many tree species. Among them was *Robinia,* named after two gardeners who planted this tree in the royal gardens of French kings. Another well known tree that has connections with Tradescant is the London plane *(Platanus x acerifolia).* In 1637 he planted the American sycamore *(Platanus occidentalis)* in the same English garden as the oriental plane *(Platanus orientalis),* where the two apparently hybridized naturally. The resulting London plane turned out to be a remarkably strong and vigorous grower that became one of the most widely planted shade trees in Europe and America.

John Bartram's botanical garden, established near Philadelphia in 1728, usually is credited as the first in America and became so famous that Carl Linnaeus called him the greatest natural botanist of the world. However, Christopher Witt actually established the first American botanical garden at Germantown, Pennsylvania in 1708. Bartram introduced more native American trees for landscape use at home and in Europe than any other person of that period. He explored much of eastern North America from Lake Ontario to Florida.

For 35 years Bartram supplied Peter Collinson of England with propagation materials from American forests, marshes, and meadows. Benjamin Franklin, the largest dealer in exchanging plants with Europe in the 18th century, helped Bartram in arranging seed and root exchanges also with France. Collinson exported seeds of several trees to Bartram, such as horsechestnut *(Aesculus hippocastanum)* and cedar of Lebanon *(Cedrus libani)*.

Other European plant explorers also were active at this time. The Swedish government in 1748 sent Peter Kalm, a pupil of Linnaeus, to report on the natural resources of America. The King of France sent his botanist Andre Michaux to America in 1785 to import trees that could replenish French forests. Michaux also sought trees "to enrich the orchard and ornamentals suitable for garden culture". From 1785 until 1807 he and his son discovered plants from southern Florida to Hudson Bay and westward beyond the Mississippi River.

The American plant collector William Hamilton, a cousin of John Bartram, introduced several trees that were widely planted, and some still are. One was the Lombardy poplar *(Populus nigra* 'Italica') in 1784, which he distributed to many plant enthusiasts along the Atlantic seaboard. Subsequently Lombardy poplar fell out of favor because of its disease problems. Hamilton also helped to introduce the Norway maple *(Acer platanoides),* the tree-of heaven *(Ailanthus altissima),* and ginkgo *(Ginkgo biloba).*

Peter Collinson gave five ginkgo trees to Hamilton in 1784, after the species had been introduced first into the Netherlands and then in 1754 to England. Engelbert Kaempfer, a German doctor and botanist employed by the East India Company, had discovered this "living fossil" in China in 1690. This ancient species has survived over 200

million years, and today is an esteemed street tree that is tolerant of urban conditions and largely free of pests.

Most foreign tree species of today were imported during the colonial period, and these were prominent in nursery catalogs along with many fruit trees and garden plants. Robert Prince established the first commercial nursery in 1737 at Flushing, New York, which became the largest and best known on the continent. The Prince Nursery sold mainly fruit trees at first, but by 1771 also shade and ornamental trees. David Landreth established the first seed business in 1784 at Philadelphia, and also a nursery. Bernard M'Mahon, an Irishman who began his seed and nursery business in 1802, was characterized by U.P. Hedrick as the first real American gardener. M'Mahon was entrusted by Thomas Jefferson with seeds brought back by the Lewis and Clark expedition of 1803-1806. The Parsons family operated another early nursery at Flushing from 1840 to 1907, offering a good selection of trees, many from Asia. By 1950 there were 17,400 nurseries in the United States that annually sold 326 million ornamental woody plants.

Princeton Nurseries, founded in 1882, is well known among the many nurseries that grow landscape trees. *Photo by Henry D. Gerhold.*

Botanical gardens and arboreta, by displaying and distributing trees, have been very influential in the choice of species used in designing urban forests. R. J. Campana proposed that Duhamel Du Monceau in

France founded the first true arboretum in 175o, which is one that includes display, scientific study, and education about trees in a collection. He assembled more than i,000 tree species including many from the New World. However the word "arboretum" did not appear until 1838 in a book by J.C. Louden. The preeminent Royal Botanical Gardens at Kew, which began privately in 1759, were given to England in 1841 and now contain more than 16,000 woody plant species. In America Joshua and Samuel Pierce started an arboretum in 1798 on a land grant from William Penn, which later was acquired by the DuPont family and became Longwood Gardens in 1921. The founding of other well known botanical gardens and arboreta in the United States includes the Missouri Botanical Garden at St. Louis in 1859, Arnold Arboretum at Boston in 1872, New York Botanical Garden in 1891, Brooklyn Botanical Gardens in New York in 1910, The Morton Arboretum near Chicago in 1922, and the U.S. National Arboretum in Washington DC in 1927.

These arboreta and others have served as sources of practical information about selecting and growing trees, and also furnished a wide variety of plant materials that could be employed in urban forestry. New varieties of trees sometimes are tried out first in arboreta before being mass-produced by nurseries for their customers. Trials in cities then can determine which species can withstand urban stresses.

Plant explorations proliferated during the 19th and loth centuries within North America and to Asia and other continents. The greatest amount of work in collecting and domesticating American plants was done from 1800 to 186o. The most avid explorers included David Fairchild and Frank N. Meyer of the U.S. Department of Agriculture,

and Charles Sargent and Ernest "Chinese" Wilson of the Arnold Arboretum. They and others greatly extended the variety of tree species in use today. For example, 379 exotic tree species are now growing in New Jersey and neighboring regions of New York and Pennsylvania that were not native in 1609 when Henry Hudson sailed to New York; only 70 of these came from other regions of North America.

Besides the exotic species that were introduced by explorers, plantsmen and tree breeders created novel varieties. Over the centuries plantsmen have sought out trees that were unusual, even bizarre. They discovered trees with colorful or variegated leaves, drooping or fastigiate branches, columnar or globose crowns, or other uncharacteristic features, and multiplied these by budding, grafting, or rooting of cuttings. Weeping varieties especially were sought after for cemeteries and parks.

Plantsmen in estates and arboreta have propagated bizarre varieties, such as this columnar Scots pine. *Photo by Henry D. Gerhold.*

In the 20th century plant breeders applied the new science of genetics to produce improved varieties through artificial mating and selection. Plantsmen also continued their work of simpler selection and propagation. The resulting named cultivars (cultivated varieties) greatly diversified the kinds of trees available for landscaping. A recent compilation of 941 validated landscape tree cultivars indicates that 64% of them originated before 1945. Since then more practical characteristics have been incorporated into improved cultivars, such as disease resistance and branching habits that require less pruning. Among 128 cultivars that are currently planted as street trees in temperate North America, 88% were developed after 1945. During this period there have been great advances in genetic and propagation techniques, but 81% of the 128 cultivars were developed by plantsmen, most of them associated with nurseries, who simply found and propagated superior trees without applying the more advanced scientific methods.

Designers of urban landscapes, who specified which trees were to be planted and where, depended first on gardeners, later on horticulturists, arborists, and foresters, for the cultivation and care of the trees. So we explore next the origins of arboriculture.

Chapter 3.

Arboricultural Practices

Arboriculture, which deals with the planting, protection, and maintenance of trees and shrubs, is one of the most important components of urban forestry. The selection of appropriate species and cultivars falls within the responsibilities of both designers and arborists. And just as the design of urban landscapes dates back to ancient times, so does arboriculture.

Early civilizations revered trees and went to great lengths for their care, because trees were thought to be under the protection of gods. More than 4,000 years ago Egyptians wrote about transplanting trees with a ball of soil and forming a basin around them to retain water. They transported trees as far as 1,500 miles by boat. *Enquiry into Plants,* written by Theophrastus (300 BC) in Greece, recommended when transplanting trees to save the entire root system, to use good soil and manure, and to orient the tree in the same direction as in its original location. Theophrastus also advocated plastering of wounds with mud and leaves to prevent drying. Early Romans were keenly interested in trees and appointed foresters to supervise their care and protection. They spread their arboricultural knowledge throughout the Roman Empire as it expanded.

ARBORICULTURE IN EUROPE

From the Dark Ages until the 15th century there apparently was little progress in the field of arboriculture. Tree care practices survived this era because faithful monks passed on their knowledge. With the revival of learning in the i 6th century ideas about tree care spread throughout western Europe and England.

Significant developments in tree care practices occurred in England especially between 1500 and 1800 in the opinion of many authors. The term arborist first appeared in 1578 in James Lyte's book, *Dodens*. William Lawson published *A New Orchard and Garden* in 1597, which discussed arboricultural practices such as planting, fertilizing, pruning, wound treatment, and cavity filling. He explained how improper pruning would eventually lead to decay. In writing about fruit trees, R. Austin in 1657 recommended feeding trees by inserting fertilizer into holes in the soil made with an iron bar, and warned about over-fertilizing.

Ancient arboricultural practices still persist, such as the pruning of these pollarded plane trees in Geneva, Switzerland.
Photo by Henry D. Gerhold.

The most renowned author in arboriculture and forestry in the 17th century was John Evelyn whose monumental book *Sylva* was published in 1662. Evelyn gave an historical account of arboricultural practices in earlier times; he offered information on transplanting trees, species selection, and diseases and insects; and suggested that trees be used for ornamental purposes along walks and in other designs. He recommended that "whole towns be planted with trees in even lines in front of the houses, so that they seemed like cities in the woods". This was not only to beautify the cities and towns but also to screen the houses from the dust of the streets. Evelyn described transplanting several hundred large trees at Versailles, and moving a tree for the first time horizontally rather then vertically in a special rig. He was also the first to advise that a tree cavity should be cleaned of decaying material and treated with oil or tar.

Evelyn also lamented improper pruning practices (which have persisted to modern times):

> *For tis a misery to see how our fairest Trees are defac'd, and mangl'd by unskilful Wood-men, and mischievous Bordurers, who go always arm'd with short Hand-bills, hacking and chopping off all that comes in their way; by which our Trees are made full of knots, boils, cankers, and deform'd branches, to their utter destruction: Good husbands should be asham'd of it...As much to be reprehended are those who... so maim the poor branches... that they leave most of them stubs, and instead of cutting the Arms and Branches close to the boale, hack them off a foot or two from the body of the Tree, by which means they become hollow and rotten...*
>
> — *John Evelyn, 1662.*

The growing popularity of expansive landscaped gardens among the more wealthy in the 1700s and 1800s required the services of "estate foresters", especially in England and France. In 1790 William Forsythe, Gardener to the King of England, gave specific instructions in his book on how to treat cavities of trees. He concocted a formula for filling cavities consisting of old lime, wood ashes, cow dung, and sand. His ingredients were disputed by others who recommended instead coating wounds with tar. William Pontey, in an 1810 treatise on pruning trees, criticized Forsythe and called attention to "the astonishing and successful exertions of simple nature in healing wounds of trees".

The Planter's Guide of Sir Henry Steuart, originally published in 1828, gave specifications for successful transplanting based on scientific principles, and criticized arboricultural practices of his day. In his opinion little progress in the knowledge of transplanting had been made since early Roman times. He recommended a root ball one foot in diameter for every inch of trunk diameter, a stan-

Machine used to transport large trees for transplanting in England.
Illustration from Planter's Guide, by Sir Henry Steuart, 1848.

dard that is still used today. Steuart recognized the need for research and proposed a Society for the Improvement of Arboriculture, so that arboriculture could become a separate profession.

Pruning techniques were advanced in the 1800s by foresters especially in Germany and France. Robert Hartig, the father of forest pathology, conducted research in Germany on pruning, wound healing, and internal decay. He clarified that fungi cause decay, not the opposite. The director of parks in Paris, Baron Des Cars, in 1864 devised a practical system of tree pruning and used coal tar as a wound dressing. He advocated cutting branches close to and even with the trunk, which was the conventional wisdom that could be traced back to Lawson. The pruning of branches flush with the trunk has persisted until recently, even though in 1756 Buchtung said "the branch collar should not be injured or removed". The scientific basis of his good advice was verified and widely advocated only recently.

Chemicals for controlling pests were seldom used in arboriculture before 185o, although insecticidal qualities of compounds such as arsenic and nicotine were known already in the 1600s. Before 1850, and even much later, insects were controlled mainly by manual and cultural methods that were labor intensive and only partially effective. Some of the pesticides developed toward the end of the 1800s are still in use today, such as Bordeaux mixture and pyrethrums.

According to W. E. Matthews, England began to fall behind in innovative arboricultural practices about the end of the 19th century, and initiatives in improving tree care swung to the United States. Commercial tree care companies started just recently in Europe, mainly since 1948.

ARBORICULTURE IN AMERICA

The development of arboriculture in America, from a craft to the profession it has become, started late in the 19th century. It gained momentum early in the loth century, and later became more solidly founded on a scientific basis through research. A series of events stimulated the interests of people in preserving and maintaining healthy landscape trees.

The creation of Arbor Day by J. Sterling Morton in 1872, for the purpose of promoting tree planting, exemplifies the increasing concern about trees in the United States and elsewhere in this period. People were becoming alarmed about extensive logging and wildfires. At the same time there was a great influx of intriguing new plants from the Orient, and a tremendous expansion of the nursery industry to meet the growing demand. Wealthy owners of elaborately landscaped estates soon recognized the need to employ workers to protect their trees and keep them healthy, and to repair those that were injured.

At Arbor Day celebrations, current and future citizens learn about community trees.

Photo by Henry D. Gerhold.

Another reason for a growing public demand for better tree care in America was the disturbance of trees by the installation of utility lines, both wires for the transmission of electricity and pipes for illuminating gas. Since the introduction of the telegraph in 1839, pruning for clearance of overhead wires has shaped and often distorted the appearance of nearby trees. Electrical lines were first installed in 1882 in Baltimore. As electrical service expanded into new areas, street trees were regarded as obstructions and dealt with in a reckless manner. Illuminating gas, which is extremely poisonous to trees, often caused injuries and fatalities; in fact, injured trees were used to detect leaks from gas mains nearby.

The defoliation of trees by gypsy moths also had a significant impact on arboriculture. This insect had been imported for hybridization with the silkworm, in the hope of enhancing silk production. A few gypsy moths escaped accidentally in 1869 at Medford, Massachusetts, though the first destructive outbreak did not occur until 1889. Various eradication and control measures were employed, with only limited success, over the next 5o years as the infestation spread first to neighboring states and then to more distant places. DDT was sprayed over three million acres of trees in the 1950s in a massive eradication program in New Jersey, New York, and Pennsylvania that was considered very successful. But by 1970 the hope of eradication was fading, in 1973 DDT was banned, and so control efforts turned to more intensive research on biological control methods.

Having recognized a need for the knowledge of tree care, George Stone taught the first course in arboriculture in 1895 at the Massachusetts State College. Possibly he had been influenced by his visit in Germany with Robert Har-

tig, the renowned authority on tree diseases. Stone was regarded as an inspiring teacher and a brilliant investigator. His course evolved into two-year and four-year curricula, as well as graduate courses. He also founded the Massachusetts Tree Wardens and Foresters Association in 1913, the first such technical organization in the United States.

John Davey, an English immigrant who founded the Davey Tree Expert Company in Ohio, published *The Tree Doctor* in 19o1 to help educate the public about trees. His company, the first in the United States that was skilled in tree surgery, was incorporated in 1909 but had started nearly 3o years beforehand. The Davey School of Practical Forestry founded in 1906 taught men how to maintain trees, and later became the Davey Institute of Tree Surgery.

The F.A. Bartlett Tree Expert Company, which started as the firm Frost and Bartlett in 1907, was a competitor of Davey and the only other large arboricultural company in North America early in the loth century. Both Bartlett and Davey pioneered commercial arboriculture. F.A. Bartlett had studied under George Stone, and John Davey also had been influenced by Stone's teachings. The Bartlett School of Tree Surgery was established in 1923 at Stamford, Connecticut to train "dendricians", the company's name for tree workers. The Davey and Bartlett schools were the principal source of technically trained arborists for many years, including the first professional tree surgeons from England. The first laboratory designed specifically for shade tree research, the Bartlett Tree Research Laboratories, was formally initiated in 1926 though studies had already begun soon after the property was purchased in 1913. Its research bulletins were comparable in quality to those of university experiment stations.

A third national tree company, the Asplundh Tree Expert Company, started in 1928 and eventually became the largest of the three. It was organized in Pennsylvania by three Asplundh brothers, all college graduates, who catered exclusively to line clearance for utility companies. The corporate image was a fleet of bright orange vehicles and machines. Asplundh may have been the first commercial arborist company to use a power saw in 1935, long before modern, light-weight chain saws had been perfected.

A new era in arboriculture began with the Shade Tree Conference in 1924 at Stamford, Connecticut. The attendees, commercial tree men and scientific specialists, recognized that the industry was largely unregulated and not well informed. F.A. Bartlett arranged the program of talks and field trips on topics including municipal shade tree problems, tree surgery, practical pruning, healing of wounds, fungi, insects, use of lead arsenate, and training of tree experts. There was no mention of arboriculture or arborists, terms with broader meanings that first replaced the terminology of tree surgery in 1928. At the fourth conference in 1928 the National Shade Tree Conference was formally organized, in 1961 it was renamed the International Shade Tree Conference, and in 1975 it became the International Society of Arboriculture.

Pruning trees under electric lines distorts their natural shapes.
Photo by Henry D. Gerhold.

Dutch elm disease (DED) was detected in North America in 193o, and quickly became the most serious disease of landscape trees. Two female graduate students in the Netherlands identified the causal fungus in 1921 and 1929, and another graduate student proved that elm bark beetles carried the fungal spores to cause new infections. U.S. scientists who had observed the disease in Europe had warned the public of this menace by 1928. F.A. Bartlett was the first to sound the alarm for arboriculture. Charles F. Irish, an eminent arborist, discovered the first known case in North America in Ohio. By 1933 a more serious infection area developed around New York City, and by 1942 six million diseased elms had been destroyed. Despite extensive control efforts the disease spread next to the Midwest, where it wreaked havoc in towns and cities that had elm monocultures along many of their streets. Eventually DED reached nearly all states and six Canadian provinces. The

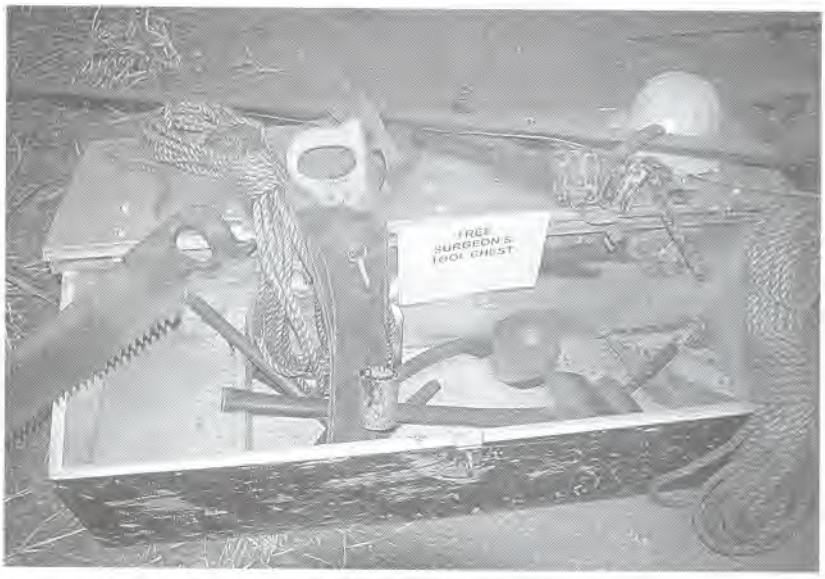
Dutch elm disease has devastated trees in many towns.
Photo by Henry D. Gerhold.

disease also has been exploited to produce some positive effects, including the promotion of professionalism in arboriculture and the support of public officials for tree management programs.

An economic disaster that started in 1929, the Great Depression, also had a positive influence on arboriculture despite the pervasive unemployment it caused. The creation of the Rural Electrification Administration (REA), the Works Progress Administration (WPA), and the Civilian Conservation Corps (CCC) provided opportunities to thousands of arborists. The REA enabled utility companies to build right-of ways across the countryside, requiring them to be maintained after trees had been cleared. From 1933 to 1942 young men in the CCC and the WPA engaged in tree planting, control of gypsy moths and diseased elms, and emergency tree clearing after the deadly 1938 hurricane in the Northeast. The WPA also trimmed trees in public parks and surveyed trees in cities. Afterwards many of these men entered careers in arboriculture and forestry. However some were not well trained and so created an unfavorable image for their profession.

During the early 1900s the principal tree care work of cavity repairs, pruning, and cabling was being broadened to include other practices such as fertilizing, spraying to control insects, and disease treatments. Before 1920 safety was not emphasized, and workers climbed trees with ladders and spurs, not ropes.

A great many inventions in the loth century made the work of arborists more effective and efficient, especially after World War II. The simple tools of the tree surgeon — axes, hand saws, chisels, ladders, climbing ropes and spurs — were supplemented or replaced by power saws and drills, aerial lifts, wood chippers, and other types of spe-



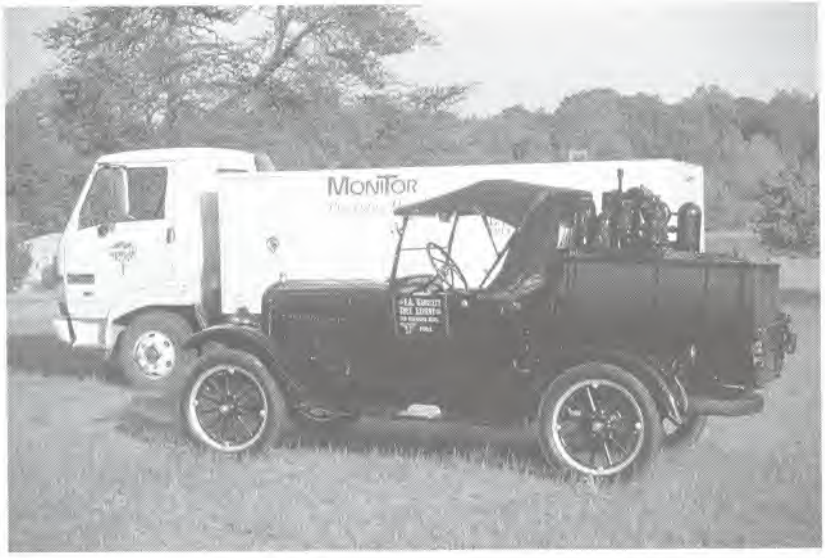
An early tree surgeon's tool chest.
Photo by Henry D. Gerhold.

cialized equipment. Trucks expedited transportation, hydraulic sprayers and mist blowers drenched tall trees more thoroughly, chain saws facilitated felling and pruning operations, chippers and stump grinders quickly disposed of pruned branches and stumps, and mechanized tree spades made it easier to move very large trees. Later advances in the scientific knowledge related to decay, other tree defects, and pruning practices enabled arborists to treat trees much more effectively. The New Tree Biology popularized by Alex Shigo after 1959 helped arborists to understand how trees defend themselves against microorganisms, and thus to improve arboricultural practices.

Arboricultural spraying practices to apply insecticides and fungicides became commonplace during the first half of the loth century, and then fell out of favor. Lead arsenate and DDT, being very effective in controlling gypsy moths and the beetles that spread Dutch elm disease, were

often used indiscriminately without regard to hazards to humans and wildlife. But after Rachel Carson in 1962 raised concerns about pesticides in her book, *Silent Spring,* new laws and regulations were passed that limited their use. The Environmental Pesticide Control Act of 1972 established tolerance levels for pesticides and required certification of pesticide applicators. In response to this challenge arborists and scientists sought more environmentally friendly ways of managing insects and diseases. The integrated pest management (IPM) concept was developed in the 1980s to reduce the need for chemicals by utilizing natural checks and balances in the landscape ecosystem, including resistant tree varieties. IPM evolved into Plant Health Care (PHC), a more holistic approach that focuses on the tree instead of the pest, and includes the client in managing landscapes.

Old and new trucks used for spraying trees with pesticides.
Photo by Henry D. Gerhold.



The number of arborists and related specialists grew at a phenomenal rate especially after World War II, as indicated by membership in the International Society of Arboriculture. The Shade Tree Conference started with about 36 people in 1924; in 1948 the National Shade Tree Conference first exceeded 1,000 members; ISA members topped 5,000 in 1989 and reached 14,836 in 2001 including 1,051 Canadians and 1,724 in other countries. These figures of course do not include all practicing arborists, urban foresters, and related scientists, whose membership in other organizations partially overlaps with ISA.

These are just the highlights of the developments that shaped the North American arboricultural industry in the past 130 years. Richard Campana's book, *Arboriculture: History and Development in North America,* describes these and others in much greater detail, including fascinating stories about influential personalities.

Chapter 4.

Urban Forest Management

The heritage of placing trees into urban landscapes and of maintaining them through tree care practices began in antiquity, as we have seen. However the management of trees in towns and cities in comprehensive, systematic programs has come about more recently. In a municipal tree management program there are clear lines of authority and defined methods for planting, arboricultural tree care, and removal of undesirable trees. A tree ordinance, tree inventory, management plan, and public involvement are features that assure continuity, effectiveness, and citizen support for the program.

Jorgensen in 1965 crystallized the concept of urban forest management that had been evolving for some time in North America. It was later brought to Europe via Great Britain, but had little impact there in the next ten years. Arboriculture was just beginning to emerge as a distinct profession, and urban forestry was regarded as a threat to its professional status. So the British at first viewed urban forestry with "a mixture of disinterest, misunderstandings and outright opposition" according to M. Johnston. After 198o other professions such as planning and landscape architecture became interested, leading to some of the first urban forestry projects in Great Britain.

Evidence of North American progress can be seen in city statutes and regulations, municipal methods for managing trees, and supportive state and national laws and policies. Furthermore the growth of professional organizations, research, and education concerned with urban forest management are indicative that the art and science of this field is maturing.

LOCAL AUTHORITY AND PUBLIC INVOLVEMENT IN THE U.S.

Civic-minded people promoted trees in their communities long ago through volunteerism and legislation. Laws to protect shade trees were enacted as early as 1635 in the "Towne of Boston". Its citizens probably can be credited with the first public shade tree planting in 1646 for the relief of travelers along a highway. The first general law in the Commonwealth of Massachusetts with any mention of trees on public ways was passed in 1786. The statewide protection of shade trees was legislated in 183o. The Tree Wardens Act of 1899 made mandatory the annual election of a Tree Warden in every Massachusetts town.

Philadelphia also accorded legal status to its trees in colonial times. An ordinance in 1700 directed every owner of a house "should plant one or more trees before the door that the town may be well-shaded from the violence of the sun". The state assembly in 1732 decreed that along with construction of a State House "walks may be laid out, and trees planted, to render the same more beautiful and commodious". The first organized street tree planting in Philadelphia took place in 1750. Fairmount Park officially was made a public park by an 1855 ordinance.

Early legislation about public trees also was enacted in other places. The territory of Michigan specified in 1807

that trees were to be planted along boulevards in Detroit and in city squares. The city council of Sacramento, California managed its trees in 1853 under an ordinance that directed plantings and removals; it created the Board of Parks in 1911. The Trees and Parkings Commission in the District of Columbia was organized in 1872, and about 80 men were employed in 1909. The Minneapolis Park and Recreation Board, founded in 1883, plants and maintains all public trees through its Forestry Division. The New York City Parks Department in 1902 became responsible for all vegetation in parks and other public places; regulations required a permit for planting, and prohibited mutilating any tree or shrub. The New Orleans Parking Commission was given control of street trees in 1909.

A novel way of managing public trees started in 1893 when New Jersey became the first state to empower municipalities through ordinances to appoint shade tree commissioners with the authority to plant, maintain, and protect street trees. Tree commissions are reminiscent of Downing's "Ornamental Tree Societies". Typically commissioners have been unpaid volunteers who provide liaison between citizens and municipal officials. Other states soon followed this model, for example Pennsylvania in 1907. Tree commissions, sometimes called boards or committees, may function in three alternative ways: advisory, policy-making, or operational.

> *It is quite incredible how much spirit (an Ornamental Tree Society), composed at first of a few really zealous arboriculturists, may beget in a country neighborhood. Some men... are too much occupied with... more important matters, ever to plant a tree, unsolicited. But these are readily acted upon by society ... Others there are ,*

who... will not begin to plant trees until it is the fashion to do so....And again, others who grudge the trifling cost of putting out a shade-tree, but who will be shamed into it... by neighbors stimulated into action by the zeal of society...In this way, little by little, the Ornamental Tree Society accomplishes its ends... We heartily commend, therefore, this Social Planting Reform, to every desolate, leafless, and repulsive town and village in the country.

— Andrew Jackson Downing, z 84 7.

So who are the practitioners of urban forest management? The approximately 90% of urban trees that are on private properties are managed piecemeal by their owners or agents sometimes with the help of commercial arborists, though private landscape trees often are not managed at all. Electric utility companies have limited responsibilities for managing trees along distribution and transmission lines, to provide clearance for safety and uninterrupted service. Municipalities have the authority for coordinated management of the trees within their boundaries, commonly the trees along streets and in parks. Some municipalities also may regulate private trees, for example to reduce dangers from diseased or hazardous trees.

The municipal tree program may be organized in various ways. Typically larger cities locate the tree program in a public works or parks department, whereas smaller towns with more limited resources rely on tree commissions and volunteers. A survey of U.S. cities in 1986 found that although 68% had a tree ordinance, only 39% had some type of systematic tree care program. Accordingly these are the towns and cities that manage their urban forests, either directly or through their policies, and often with the help of volunteers.

MUNICIPAL TREE MANAGEMENT IN NORTH AMERICA

The management of trees on public property, which in many places is well organized nowadays, has been fairly well documented in recent decades. In contrast the trees on private property have been managed in more variable ways or not at all, and there is little summary information about private tree care practices.

The management of municipal trees, consisting mainly of planning, planting, maintenance, and removal of trees along streets and in parks, should start with an inventory of trees and resources. Early recommendations for inventorying and managing city trees were made by Landreth (1895), Solotaroff (1911), and Vick (1919), but other management practices began before then as already noted. Master street tree plans, which specify species to be planted and are based on tree inventories, were in vogue especially before computerized inventories led to management

Modern municipal tree management is based on inventory data.
Photo by Henry D. Gerhold.

information systems. The major functions of software for managing urban trees are to store tree inventory data, record work on trees, handle service requests, summarize data, generate lists of trees, and map tree locations. A 1973 survey of 166 U.S. cities and six in Canada found that only 3o% had conducted tree inventories, and fewer than 3% handled data by computers. By 1979 fourteen cities were using computers and six inventory systems had been developed for general usage. In 1986 about 9% of U.S. cities had computerized tree records. However there was an apparent decline in cities managing their trees systematically, from 56% in 1974 to 5o% in 1980 to just 39% in 1986; only 17% had a documented management plan.

Early in the loth century some of the more progressive cities were applying the arboricultural knowledge of that era in their management practices. An article in 1910 claimed that in New York City, "forestry has been developed more extensively than anywhere else in the country"; a graduate of the Yale Forest School was in charge of 150,000 street trees and employed 600 to Boo workmen. In various cities suitable species and their characteristics were being identified. Planting sites were being evaluated and modified. Planting methods included staking, watering, and protective devices against injuries by people and horses. Pruning techniques believed to be proper at the time were known, but often not followed. Common causes of injuries were recognized, including poor soil, dumping of salt used in freezing ice-cream, air pollutants and escaping illuminating gas, oiling of roads, butchering of trees near wires by ruthless linemen, mutilation by horses, street building, and a wide variety of insects and diseases. Tree repair methods included filling of cavities, tree surgery, cabling, and bridge-grafting over bark injuries.

In the latter part of the loth century many innovations and improvements in arboricultural methods were utilized by municipalities. Also a broader view of urban forest management developed, probably resulting from the increasing involvement of professional foresters. Consequently forest management concepts such as age structure, species diversity, and rotation period became more common in municipal tree management plans in the 1980s. Terms such as green infrastructure, land use planning, native versus foreign species, and urban ecosystems are now being discussed, and may further expand the scope and sophistication of urban forest management in the future.

URBAN FOREST MANAGEMENT IN EUROPE

Traditionally, Europeans have regarded the urban forest as being just outside the city, which is different from the American concept. European communities typically own those forests for recreation, timber, game, and watershed protection. Furthermore there is a tradition in many countries of every man's right of free access to the forest, regardless of ownership, for recreation but not for hunting. A British view is that such an urban forest should have a minimum size of at least 0.5 acre or 0.25 hectare. The urban forest in Germany currently is viewed as having three components, whose functions are coordinated by the urban planning process: a peripheral forest belt that provides spaces for recreation and watershed protection, radial green arms reaching into the city, and greenspaces dotting the inner city.

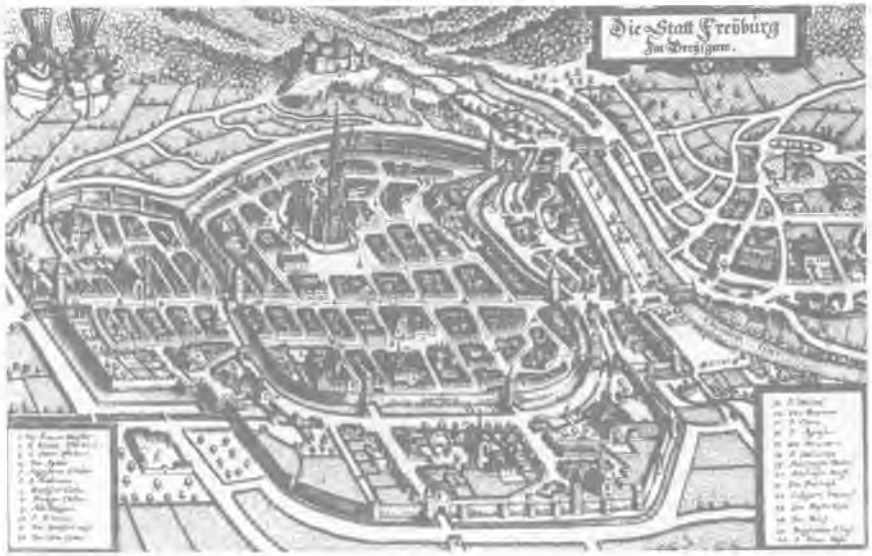
In the second half of the 19th century urban planning and services were carried out in a more organized way than before, and city and national governments provided more urban greenspaces to the public. The city council of Trond-

heim, Norway in the 1860s decided to manage its forests to reduce the impacts of wind and dust, and to secure the beauty of forest land for people's recreation. Public beautification committees in Prague undertook the first major reforestation efforts between 1897 and 1908. The Dutch forest service established in 1899 was responsible for state-owned urban forests. In Great Britain, too, the emphasis was on "urban fringe forestry" around towns, for already by 1900 80% of the population was living in larger towns and cities.

European city governments exercise more managerial authority over trees than in America with less participation by the public, although there is considerable variation among countries. City greenspaces in Germany are managed by private citizens, public institutions, or city employees. C. C. Konijnendijk's study of 16 cities in nine countries concluded that forest management plans were common in

Freiburg, Germany, about 1663, fortified with walls and a moat surrounded by fields and forests, contained few trees in the Old City.

By permission of Edm. von Koenig-Verlag, Dielheim, Germany.



all cities, but "holistic, structured and formal urban forest policies are rare".

Formal urban forest management plans and inventories apparently have come into use only recently in Europe, although public trees have been cared for systematically long ago so the concept cannot be new. J. C. Guerin wrote that in Paris the Park, Garden and Forestry Administration in 1986 finally was given jurisdiction over municipal trees so they could start to manage them. Yet 75 years earlier W. Solotaroff had corresponded with the person who had jurisdiction over the trees of Paris, indicating they had been counted, were being maintained, and new trees were being planted. Remote sensing has been used recently to inventory the trees in Freiburg and Munich for planning purposes.

In the United Kingdom legislation has dealt mainly with protecting trees, not managing them. The Town &

Freiburg about 1994, similar aerial view with cathedral near the center, still with few trees in the city.
By permission of Edm. von Koenig-Verlag, Dielheim, Germany.

Country Planning Act of 1947 created the basis for Tree Preservation Orders. In 1974 the Town and Country Amenity Act gave trees even more protection in conservation areas. The Town & Country Planning Acts of 1971 and 1990 have empowered local planning authorities to protect amenity trees.

U.S. LAWS IMPLEMENTING URBAN FORESTRY

A growing national interest in urban forestry became evident in 1967, when several U.S. agencies appointed committees or task forces. Prior to this the state of Georgia had started a Metro Forestry program in 1966, and several other states soon followed suit. For example, Kansas funded its Rural Town Forestry Assistance program in 1972, and the Pennsylvania Bureau of Forestry appointed an urban forester in 1973.

Urban forestry was added to broaden the mission of the USDA Forest Service in 1972, and its Urban Forestry Assistance Program was first funded modestly in 1978. From the start the Forest Service has participated actively in partnerships with state agencies, universities, and professional organizations such as American Forests, the International Society of Arboriculture, and the National Arbor Day Foundation. The USDA Cooperative Extension Service also became involved in providing technical assistance.

In 1990 President George Bush proposed the America the Beautiful program, which was enacted in the 1990 Farm Bill that increased federal funding for urban forestry to $21 million. This created the Urban and Community Forestry Assistance Program administered by the Forest Service, which provides education, technical assistance, and grants to municipalities and local groups through state forestry agencies. The National Tree Trust also was formed

to stimulate public awareness, volunteerism, and local tree planting. During 1999 the Urban and Community Forestry Program of the Forest Service in the 20 northeastern states provided nearly $21 million in grants to states, partners, and special projects. The states in turn assisted 5,474 communities with grants and technical information.

PROFESSIONAL ORGANIZATIONS

Urban forest managers and related professionals rely on several organizations to exchange information and to promote their interests through research, education, public relations, and legislative influence. Besides the main North American organizations described here, there are similar organizations in other countries, and also other associations that serve important related fields such as entomology, pathology, genetics, soils, horticulture, and nurseries.

The International Society of Arboriculture (ISA) is the principal and most comprehensive organization oriented to urban forestry. Its development from the Shade Tree

Municipal arborists learn from each other during field trips at professional conferences.
Photo by Henry D. Gerhold.

Conference founded in 1924 was noted previously. Since 197o ISA has been organized with five constituent groups, currently named Arboricultural Research & Education Academy, Society of Municipal Arboriculture, Society of Commercial Arboriculture, Student Society of Arboriculture, and Utility Arborist Association. In 1973 ISA first convened an Urban Forestry Committee. ISA holds annual and regional conferences, publishes the *Journal of Arboriculture* and other publications, certifies arborists, and awards research grants.

Municipal arborists and city foresters have been meeting at annual ISA conferences since 1947, at first informally. By 1957 they had an official committee but were not entirely satisfied with annual conference programs. So a dissident group broke away from ISA in 1964 and formed the Society of Municipal Arborists. Its annual meetings always included a tour of a municipal tree program and emphasized practical topics. Some municipal foresters remained with ISA, being identified as the Municipal Arborist Association in 1972; in 198o they became the Municipal Arborist and Urban Forestry Society, and in 1997 merged with the independent Society of Municipal Arborists, which joined ISA and retained its name. Its magazine, *Trees,* later became *City Trees.*

The National Arborist Association that originated in 1938 is a trade organization for commercial arborists and tree experts. Its roots also can be traced back to the National Shade Tree Conference. The main activities and achievements have been concerned with public relations, standards for arboricultural and safety practices, and training of arborists. *Tree Care Industry* has been its principal publication since 1990, before which a variety of bulletins, pamphlets, and reports had been published.

The American Forestry Association (now American Forests, AF) made a commitment to urban and community forestry that has been implemented in several ways, including articles in its magazine *American Forests,* helping to establish a National Urban and Community Forestry Leaders Council in 1981, and advocating legislation. In 1981 AF began a newsletter, *Urban and Community Forestry Forum,* renamed *Urban Forests*. AF also has sponsored National Urban Forestry Conferences after the first one had been held in 1978.

The Society of American Foresters (SAF) serves the national interests of professional foresters centered on the management of forests for multiple uses. Urban forestry received little attention until 1972, when SAF formed an Urban Forestry Working Group to provide liaison with other organizations such as the International Society of Arboriculture. One of its initial concerns was to define urban forestry, a term which seemed strange to many of the SAF members. By 1980 the working group had more than 700 members, one-third of whom chose it as their primary interest above 28 other working groups. The group has carried out various activities, including a newsletter, programming at the national conventions, and compiling a bibliography and a directory of members.

The National Arbor Day Foundation (NADF), created in 1972, has been a catalyst for community tree care through its Tree City USA program that began in 1976. The Tree City USA Award recognizes municipalities with a legally constituted tree body, a tree ordinance, a forestry program funded at least minimally, and a yearly Arbor Day proclamation and tree planting ceremony. In 1991 NADF introduced the Tree City USA Growth Award to encourage communities to continually improve their tree programs.

Tree City awards by the National Arbor Day Foundation induce communities to improve their tree programs. *Photo by Henry D. Gerhold.*

The number of tree cities has grown from 42 in 1976 to 2,619 in 1999. NADF has published many practical bulletins, and has held conferences on a wide variety of topics since its Lied Conference Center opened in 1994 at the birthplace of Arbor Day in Nebraska.

RESEARCH AND EDUCATION

In the United States universities have been at the forefront of research into urban forestry topics. Together with federal and state agencies they have led the world in research into urban tree selection, establishment, maintenance, and management. Research by private industries usually has been product oriented, and often has been conducted via grants to universities.

The USDA Forest Service in 1970 created the novel Pinchot Institute of Environmental Forestry Studies, enabling the Northeastern Forest Experiment Station to sponsor research related to urban forestry through ten member universities. The institute also co-sponsored the First National Urban Forestry Conference in 1978, together with the New York College of Environmental Science and Forestry.

International collaboration in urban forestry research has increased significantly in recent years. A European Union-financed project named COST Action E 12 'Urban Forests and Trees' has compiled an overview of European research. Reports provided by 20 countries categorized 404 research projects, recognizing that some are concerned more with woodlands than city trees and that the scale of the projects varies widely. Apparently 275 projects dealt with woodlands, 278 with parks, and 266 with streets, obviously with overlaps in the type of site. Categorized another way, 199 were concerned with planning, design, and benefits of trees; 155 with selection and establishment of trees; and 138 with management, which can be divided between 32 on information systems and management and o6 on maintenance of trees including disease and abiotic stresses. The intent of COST E 1 2 is to coordinate urban forestry research, avoid duplication, and improve efficiency. Its leaders believe there has been better coordination in North America.

Urban forestry curricula in colleges and universities arose gradually in departments of forestry, horticulture, or landscape architecture, as arboriculture and urban forestry were latecomers compared to other priorities in these departments. Bernard Fernow and William Solotaroff, a shade tree commissioner in New Jersey, wrote two of the first texts dealing with landscape tree maintenance in 1910 and 1911. Fernow, educated in Germany, had been the first chief forester of the United States and had presented the first forestry lectures at the Massachusetts Agricultural College in 1887. He also has been a professor or lecturer at Wisconsin University, Cornell University, Pennsylvania State College, and the University of Toronto.

A 1975 survey found that 33 universities had initiated new courses and curricula in urban forestry since 1968, but many of them had no specific offerings in arboriculture or urban forestry at that time. A survey of employers in 1984 found that graduates of two-year arboriculture programs and four-year urban forestry programs were expected to master a wide array of skills and knowledge, including contemporary tree-care procedures, tree selection, plant materials, disease and insect control, public relations, budgeting, planning, and management. Another study found that the number of U.S. institutions offering urban forestry courses had increased from 11 in 1970 to 3o in 199o. A current survey of European higher education in urban forestry found that very few degree programs exist, and that several of these were set up just recently.

The broad scope of subjects in urban forestry is indicated by courses now taken by students that specialize in this curriculum. A 1995 survey of 101 institutions that offered courses in arboriculture, urban forestry, and related subjects listed 18 subfields beyond the basic or general education subjects; 50 of these institutions were in the United States. The most common courses dealt with general urban forestry, arboriculture and landscape plant management, plant materials and taxonomy, soils, pests and diseases, landscape architecture, and work experience or internship.

Urban forestry has come to mean much more than applications of arboriculture and landscape design. Today it includes some aspects not obvious in Jorgensen's broad definition of 1970, such as municipal and regional planning for the management of natural resources and urban ecosystem management.

Chapter 5.

Community Trees and Our Future

TREES IN OUR COMMUNITIES — what a wonderful, inspirational, invaluable heritage!!! These trees that enrich our lives in so many ways have endured urban stresses through the ages. For a very long time they were at the mercy of rulers, the wealthy, and the vagaries of nature. Then a few centuries ago, here and there, landscape designers and gardeners became more active in helping urban trees to thrive. The professions of landscape architecture and arboriculture evolved next, and then urban forestry. Finally ordinary people, as they gained influence and knowledge about landscape trees, were able themselves to take on a shared responsibility with their communities for having trees planted and given proper care.

Along with this growing concern for trees, the knowledge and tools used in tree care practices progressed slowly and precariously for a long time. Traditions passed along orally at first later were recorded and published, so scientific and practical information about trees could be disseminated more widely, critiqued, and improved. Not until the 20th century did research and education about community trees flourish, leading to more diverse and improved tree varieties, more effective arboricultural practices, and people skilled in using them.

Now we have all the arts, sciences, tree varieties, and professionals needed to landscape our communities, and to understand and appreciate the benefits of urban forests. So why aren't more towns and cities tending to their trees? Some have excellent community tree programs. Other communities have none, their landscapes show the neglect, and the residents may not even realize what they are missing.

Fortunately ordinary citizens have the persuasive power to get a tree program started or to improve an ineffective program, as has been demonstrated repeatedly. One person can spark this initiative, persuade a few others to help build public support, and convince community leaders to take action. And help is available in the United States from every state forestry agency or extension service, including technical advice, publications, and grants.

City trees are the "pot of gold" at the end of this rainbow.
Photo by Henry D. Gerhold.

So we hope some readers will be inspired to look anew at trees in their communities, to appreciate them more fully, and to investigate what is being clone to care for them. What might you do to enhance our heritage of community trees, and to conserve this heritage for our children and grandchildren?

SOURCES OF ASSISTANCE

- Your state forestry or natural resources agency
- Your state cooperative extension service
- International Society of Arboriculture,
  P.O. Box 3129, Champaign IL 61826-3129;
  phone 217-355-9411; e-mail isa@isa-arbor.com ;
  www.isa-arbor.com
- National Arbor Day Foundation,
  211 North 12th Street, Lincoln NE 68508;
  phone 402-474-5655; www.arborday.org
- Pennsylvania Urban & Community Forestry Council,
  56 East Main Street, Mechanicsburg PA 17055;
  phone 717-766-5371

  A Guide for Municipal Tree Commissions,
  48p., $10.00

  Fundraising for Community Tree Projects,
  29p., $10.00

  Community Forestry Volunteers, 15p., $7.50

- Agricultural Publications, Penn State University,
  112 Agricultural Administration Building,
  University Park PA 16802; phone 814-865-6713;
  toll free 877-345-0691; http://pubs.cas.psu.edu

  Landscape Tree Factsheets, 444p., $30.00

  A Guide to Preserving Trees in Development Projects,
  single copies free

  Planting and After Care of Community Trees,
  single copies free

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