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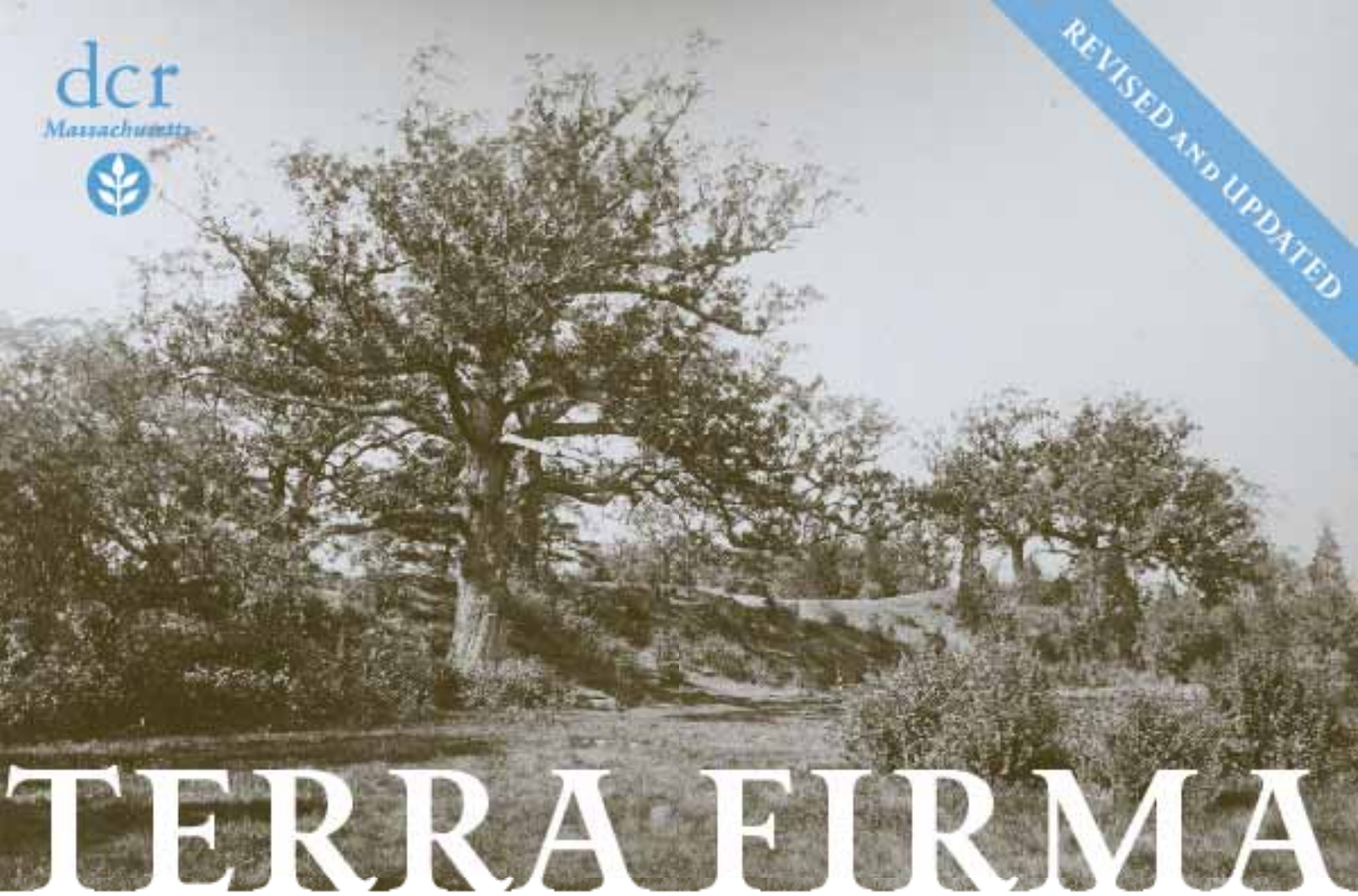

TERRA FIRMA

PUTTING HISTORIC LANDSCAPE PRESERVATION ON SOLID GROUND

"The best friend on earth of man is the tree. When we use the tree respectfully and economically, we have one of the greatest resources of the earth."

FRANK LLOYD WRIGHT

A Publication of the Massachusetts Department of Conservation and Recreation's Historic Landscape Preservation Initiative

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Massachusetts

Mission: To protect, promote, and enhance our common wealth of natural, cultural, and recreational resources for the well-being of all.

The Massachusetts Department of Conservation and Recreation (DCR) is steward to over 450,000 acres throughout Massachusetts. For more information on the DCR and the Massachusetts State Park system, visit www.mass.gov/dcr, call 617-626-1250, or write to DCR, 251 Causeway Street, Boston, MA 02114.

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Massachusetts is a tapestry of historic landscapes — places that, through a combination of natural and human-made features, help tell the story of a historic event, activity, or person, or reflect a community's historical development or traditions. Trees greatly enhance the character of historic landscapes, such as town commons, public parks, and cemeteries; in many cases, it is nearly impossible to imagine these places without trees. Along with other vegetation, trees affect the scale, light, color palette, and even the smell of a landscape — in short, how we experience and remember these important places. The protection and thoughtful treatment of trees is therefore a critical element of almost any historic landscape preservation effort.

This second edition of Terra Firma #2 *covers the care of mature trees in historic landscapes, including identifying trees that are historically significant, providing basic care for mature trees, and selecting an appropriate replacement when a tree must be removed. It is not a comprehensive guide to tree care and does not address all issues related to vegetation in historic landscapes. Resources that provide further guidance are noted throughout the text and on the back cover. First published in 2006,* Terra Firma #2 *has been out of print since 2010. This update adds new information on threats to historic trees, including invasive pests like the Asian longhorned beetle and the emerald ash borer and catastrophic environmental events. There is also an expanded section on planning tools, and state and local regulations.*

Cover image: The Waverley Oaks at Beaver Brook Reservation, Waltham, MA (1896). Created in 1893 to protect these 22 ancient white oaks, Beaver Brook Reservation was the first park in the Metropolitan Parks System. Areas of natural beauty, including unique forests and tree collections, were identified by landscape architect Charles Eliot in his plan for the first-in-the-nation regional park system. Offspring of these ancient oaks can be seen at Beaver Brook today. Photo courtesy DCR Archives.

"Each generation takes the earth as trustees. We ought to bequeath to posterity as many forests and orchards as we have exhausted and consumed."

J. STERLING MORTON


1

WHAT MAKES A TREE HISTORIC?

Many people recognize trees as important natural resources – they clean our air, cool our city streets, and protect our watersheds. Some trees are also significant as historic resources – either individually or by contributing to the overall character of a historic landscape. A majestic oak may mark the site of an important event. An apple orchard may reflect regional agricultural traditions. Ornamental trees in a historic garden may tell us not only about the intent of the landscape designer but also about the aesthetics of a certain time period. Trees in less formal settings – dotting a town common, for example – may not have been planted according to an overall plan but are no less important in establishing the character of the landscape.

The Commonwealth's rich collection of historic landscapes incorporates an equally important collection of historic trees.

1 *Littleleaf Linden, Marshfield* This massive linden tree on the Thomas-Webster Estate in Marshfield is historic not only in its size and placement within the estate but for its association with Daniel Webster.

2 *Council Oak, Dighton* Located in present-day Dighton, the Council Oak was a significant meeting place for the Wampanoag Federation for centuries. By 2002 the tree died, following severe damage by lightning and wind. Today a historical marker stands at the site, but a new tree has not been planted.

3 *Orchard, Pepperell* Orchards, like this example in Pepperell, may reveal the historic use of a property or the agricultural practices of a region. While no one tree may be individually significant, they collectively comprise a vernacular landscape.

4 *Sugar Maple Allée, Canton* Two rows of evenly planted trees, usually of the same species, create a walk known as an allée, a frequent feature of designed landscapes. Shown is the former Howe Estate at Brookwood Farm, part of DCR's Blue Hills Reservation in Canton.

Photo courtesy of Bowen Litterer, early 1930s


2


3


4

Photo courtesy of DCR Archives

Trees along historic parkways can enhance the planted median, screen views, articulate road alignment, and provide a lush overhead canopy. The Fellsway, shown c. 1895, is listed on the National Register of Historic Places as part of the Metropolitan Park System of Greater Boston.

TREE CARE WITH A PRESERVATION PERSPECTIVE

Historic trees – whether significant in their own right or part of a cultural landscape – may demand a level of care beyond that provided to other trees. Where the loss of a tree would have a negative impact on a historic landscape, preventive care, such as fertilization, mulching, and disease control, is critical to ensure that the tree survives for as long as possible. Similarly, it may be wise to extend the life of a mature tree that has historic value, through pruning, cabling, or other methods, while in another context a tree in a similar condition might be removed. In other words, historic trees should be treated not just from an arboricultural perspective, but also from a preservation perspective.

Even a modest maintenance regime will increase the health and extend the life of a mature tree. Some tasks may be performed by municipal staff or volunteers, while others are best left to a professional arborist – someone who is specially trained in the care of trees. Selecting an arborist who is certified can offer additional assurance that the job will be done well. Arborists who are certified by the International Society of Arboriculture (ISA) or who have passed the Massachusetts Certified Arborists (MCA) examination must demonstrate a minimum level of knowledge and complete ongoing training in order to maintain their certification.

PLANNING TO PRESERVE

Mature shade trees, specimen trees, and artfully designed allées are often identified as character-defining features of historic landscapes. The preservation treatment for specific trees should be considered when developing the landscape preservation plan. That might include conducting a tree-by-tree inventory in a historic cemetery designed as a horticultural showcase or doing a forest management plan for a historic former estate with woodlands planted as an experimental forest. Property managers can use historic plans and records to determine whether existing trees are part of the original design and how to best preserve them.

A preservation plan includes information about the historic development of the landscape; an assessment of the site's overall condition and the condition of individual features, including vegetation; and the identification of a preservation treatment approach. Through the planning process, historic property managers and stewards can develop a preservation approach balancing the significance, preservation priorities, and current management goals of the historic landscape.

For general information on the identification and preservation of historic landscapes, see *Terra Firma #1*.

BEST MANAGEMENT PRACTICES

Regular inspections will help you assess the health and structural stability of your trees and identify any problems, such as dead limbs that need to be removed and signs of disease, detrimental insects, or trunk decay.

Mulching keeps the soil around the tree cool and moist, discourages the growth of weeds, and eliminates the need to mow near a tree's base, which can cause damage. If appropriate for the historic landscape, organic mulch should be spread at a depth of 2"-4" and cover as much of the tree's root system as possible. (Root systems can extend up to 2-3 times the diameter of a tree's branch spread; when mulching to that extent is not practical or desirable, apply mulch to as much of the area under the tree's drip line as possible.) It is very important that mulch not cover any part of the tree trunk, as this can encourage disease; it is best to maintain a mulch-free area in a 1"-2" ring around the tree base.

Aeration can address problems caused by compacted soil by increasing a tree's oxygen supply, root growth, and water uptake. Aeration typically involves the drilling of holes in the ground throughout the tree's root zone, and should be performed by a certified arborist.

Aeration

Photo courtesy of Michael Davidshn, UMass LARP

Static Cabling

Pruning

Fertilization can balance the soil's nutrients and adjust its acidity, which can improve tree development and health. Fertilization is not always recommended for mature trees and should always be preceded by an analysis of existing soil conditions by a certified arborist. Misapplication of fertilizers can harm a tree and should only be undertaken based on diagnostic testing.

Insect and disease control methods vary considerably. Depending on the situation, a certified arborist might recommend application of insecticides or horticultural oils or removal of an infected limb, among other solutions (for more on pests, see pages 8-10).

Pruning may be necessary to remove dead or diseased (and dangerous) limbs, to improve the overall tree structure, or to influence the growth of the tree by increasing light and air penetration. Mature trees must be pruned carefully by a certified arborist with the proper training, skills, and equipment (see *Helping Trees Endure the Slings and Arrows (and Pests and Storms) of a Long Life)* at the center of this bulletin). Removing branches at a tree's crown to reduce height – or "topping" – is never recommended, as it causes severe stress and can create hazards. If height reduction is needed, consult an arborist.

Tree supplemental support systems are used to reduce the hazard potential of trees with structural defects by providing extra support during periods when additional loads are placed on the tree (i.e., snow and ice loads or severe winds). There are five types of support systems:

Dynamic Cable Non-invasive cabling system designed to provide additional temporary support during periods of excessive loads (such as wind) on the tree parts.

Static Cable (steel cable) Invasive cabling system that provides constant additional structural support.

Bracing (threaded rod and bolts) Threaded rod system designed to hold failing tree parts together.

Props Rigid structures built on the ground that support a branch or trunk.

Guy Wires (directional support) Guying is the installation of a cable between a tree and an external anchor to provide supplemental support and reduce tree movement.

While cabling and bracing may prolong the life of a tree, such practices do not eliminate the hazard. Work should be undertaken in conjunction with a regular inspection program under the direction of a certified arborist.

DCR's Urban and Community Forestry program provides free information on mature tree care as well as links to the publications of the International Society of Arboriculture (Trees Are Good) and the Massachusetts Arborist Association at http://www.mass.gov/dcr/stewardship/forestry/urban/index.htm.

The Secretary of the Interior's Standards for the Treatment of Historic Properties defines nationally accepted preservation principles. The supplemental *Guidelines for the Treatment of Cultural Landscapes* includes recommendations about the treatment of trees in historic landscapes. View the guidelines at http://www.nps.gov/history/history/online_books/hps/contents.htm.

This American Sycamore in Sunderland is over 112 feet tall, has a circumference of nearly 25 feet, and was standing in 1789 — though it may be much older. It is the largest of its species in the state and is a Massachusetts "champion tree," a designation based on a tree's trunk circumference, height, and crown spread.

For more information on "Big Tree" designations, visit www.massforests.org or www.americanforests.org/our-programs/bigtree/.

WHO'S IN CHARGE?

A variety of individuals and municipal groups may have a stake in the treatment, removal, or planting of trees in a historically significant landscape. Getting input from all parties up front will minimize chances for misunderstanding and can help lay the foundation for a team approach to future tree projects. If you want to know who is in charge, first identify your Tree Warden (www.masstreewardens.org), who may also be involved in one of the local departments or commissions. Depending on the community, public shade trees and trees in historic public landscapes may be under the care of the Tree Warden and others:

Department of Public Works Crews assigned to the maintenance of public roads may also undertake maintenance (pruning, thinning, and removal of hazards) on trees within the public way.

Parks and Recreation Department The Parks Department may have overall responsibility for the care and upkeep of historic parks, cemeteries, and town commons, including the collection of mature trees.

Public Shade Tree Committee An independent body of citizens whose primary purpose is to advise the Tree Warden. A Tree Committee may also be a sub-committee of another body, such as the Conservation Commission, or the Tree Committee may function as the Tree Warden.

Planning Board Planning Boards have jurisdiction over the removal of any public shade trees or existing stone walls in a public way designated as a scenic road under the Scenic Roads Act (MGL Ch.40 Section 15c). The law requires that any proposal to remove public shade trees or stone walls must undergo a Planning Board public hearing to solicit public input. The board must then decide whether or not to allow the removal of the features and if any conditions should apply.

Cemetery Commission In some communities, elected officials appoint three individuals to serve on a Cemetery Commission, which can advise the Cemetery Superintendent on how to manage the tree collections within public cemeteries.

For examples of local ordinances and bylaws, see DCR's Urban and Community Forestry program website at http://www.mass.gov/dcr/stewardship/forestry/urban/index.htm.

Some situations call for outside expertise. If your town does not have a certified arborist on staff, you may need to retain a private contractor to devise treatment plans, undertake advanced work, or suggest appropriate replacement trees. If the tree in question is part of a larger landscape that requires a plan to guide its overall care and rehabilitation, a landscape architect with experience in historic properties may be hired to create a landscape preservation plan addressing all elements of the site, including vegetation.

Additionally, public landscapes often benefit from the interest and support of private non-profit groups, such as Friends groups and Garden Clubs. While not directly in control of the treatment of historic trees, these groups can advocate for urgent tree preservation priorities, raise funds, and augment city resources through volunteer efforts. Finally, communities may also find a willing partner in their local utility company, which has experience and resources to manage trees in the public way.

REGULATIONS AND PLANNING TOOLS FOR TREE PRESERVATION

The strongest form of protection for public trees is the creation of a local ordinance or bylaw, and, to date, 108 Massachusetts communities have done so. The City of Worcester passed a strong tree ordinance in 2008, following severe tree loss in the wake of the Asian longhorned beetle infestation. The City of Cambridge has one of the most rigorous ordinances, providing for protection of "Significant Trees" (> 8" caliper) during construction, provisions for mitigation of damage to significant trees, and creation of a Tree Replacement Fund. Every community should consider enacting a tree bylaw that makes sense for their community.

Massachusetts has the United States' oldest law regarding the protection of public shade trees. Massachusetts General Laws Chapter 87, also known as the Shade Tree Act, was enacted in 1898. The act requires every city and town to designate a Tree Warden who shall have "care and control of all public shade trees, shrubs, and growths in the town." The act also establishes a public process related to the function of the Tree Warden, whose duties may include:

- authority over all decisions regarding tree removals, protection, or treatment (e.g., pruning)
- approval of tree plantings in a public way
- planting of shade trees acquired with public or private funds in a public way
- maintenance of trees, shrubs, and growths in a public way
- establishing and enforcing regulations for the care and preservation of public shade trees, including provisions for fines

"No town can fail of beauty, though its walks were gutters and its houses hovels, if venerable trees make magnificent colonnades along its streets."

HENRY WARD BEECHER

Town commons, like this one in Hopkinton (top), are often dotted or edged with historic trees that are usually intentionally planted and contribute to a community's character. Local ordinances and bylaws can help protect trees in public parks and along roads (Princeton, bottom). For example, a local scenic road designation can protect the stone walls and trees within the public way (for more, see DCR's Terra Firma #3 — Identifying and Protecting Historic Roads).

THREATS TO HISTORIC TREES

PRIORITY PESTS IN MASSACHUSETTS

Asian Longhorned Beetle

Responsible for the loss of over 30,000 trees in the Worcester area, the Asian longhorned beetle (ALB) is 0.75"-1.5" long with antennae that are 1 to 2 times its body length. Adults are shiny black with irregular white spots and alternating black and white bands on their antennae. The female beetle chews dime-sized oval grooves in the bark to deposit her eggs. Once hatched, ALB larvae eat away at the trees' outer sapwood, beneath the bark layer, creating hollowed-out galleries or tunnels in the wood. Adults then bore out of the tree, creating exit holes 3/8" or larger in diameter. Adults are active from early summer through mid-fall, and there is no treatment for infestation other than complete eradication. In addition to identifying the beetle, residents may see the perfectly round exit holes, "frass" or coarse sawdust near the holes, exposed wounds, oozing sap, or areas of exposed wood where larval tunneling has occurred. For more information, visit Massachusetts Department of Agricultural Resources (MDAR) website http://www.mass.gov/agr/alb.htm.

Emerald Ash Borer

The emerald ash borer (EAB) was confirmed in the Berkshire region of Massachusetts in September 2012. The EAB is a small, flying green beetle, native to Asia. It was first discovered in North America in 2002, in the Detroit, Michigan area. Unlike other invasive beetles, the EAB can kill a tree fast, within just a few years, because it bores directly under the bark, where the tree's conductive system is. Since its discovery in North America, it has killed millions of ash trees and has caused billions of dollars in economic loss across the nation. Here in Massachusetts, ash is a main component of the Northern Hardwood forest, typically found in the Berkshires, and a common street tree in eastern Massachusetts. Residents are urged to take the time to learn the signs of EAB tree damage and to report any sightings. Look for tiny, D-shaped exit holes in the bark of ash trees, die-back in the upper third of the tree canopy, and sprouting of branches just below the dead area.

Winter Moth

Landscapes and private yards with mature oaks and maples may become virtual "moth gardens" around Thanksgiving when the adult winter moth emerges to lay its eggs on host plants. It is in the spring, though, that the young caterpillars do their damage, feeding on buds and leaves in May and June. Winter moth caterpillars commonly feed upon all maples, oak, apple, crabapple, ash, fringetree, and blueberry; and they have been known to drop from trees and feed on perennials such as roses. Winter moth eggs hatch any time from late March into the second or third week in April. The tiny (less than 1 mm) caterpillars then spin a small silk strand and become air buoyant and are blown upward into the tree canopy, where they feed on leaf and flower buds through late May or early June. Then they drop to the ground and pupate in the soil until late fall. If you see the moths in the fall, consult with an arborist to consider spring treatment.

TOP FIVE WAYS TO PROTECT OUR HISTORIC TREES FROM PESTS:

- Learn how to spot the pests and report them (http://massnrc.org/pests/)
- Work with an arborist to treat affected trees immediately, even if it means removal
- Buy firewood where you intend to burn it to avoid relocating pests harbored in the wood
- Avoid planting homoganous stands of trees; diversity of species can halt spread of pests
- Heed all quarantines, including restrictions on nursery stock from Massachusetts and other infested states (maps are available for download at http://massnrc.org/pests/alb/)

HELPING TREES ENDURE THE SLINGS AND ARROWS (AND PESTS AND STORMS) OF A LONG LIFE

Trees are long-lived organisms, which is especially true if they occupy healthy sites that promote growth and if they are given a little help on occasion. Throughout the long life span of that magnificent oak in the local cemetery, it will face an array of challenges, some serious, others more of a nuisance, that threaten its health. Fortunately, trees possess truly remarkable abilities to endure the hardships and assaults of life with an admirable stoicism. Indeed, when gazing upon the twists and gnarls of an old tree that has withstood the vicissitudes of time, one comes to appreciate the silent, enduring capacity of trees to survive. It is certain that trees will meet and overcome most of life's challenges with no help from humans. However, this fact should not dissuade managers from taking steps that will supplement a tree's innate abilities to surmount difficulties.

Watering

Newly planted trees should receive about 20 gallons of water per week during the growing season, using a deep, infrequent watering method to infiltrate the soil. Placing a garden hose from which water is flowing at a moderate rate next to a young tree and letting the water run for twenty to thirty minutes will ensure that enough water has been supplied and to the proper soil depth. In recent years, water bags that can be attached to or laid at the base of trees have been developed that offer another good option for slow, deep watering.

During periods of drought, mature trees benefit from occasional supplemental watering as well. However, watering mature trees is a big job. The sprinkler set out to water the lawn under the tree in the side yard is not likely to provide enough water for both the turf and the tree without also generating a prohibitive water bill. The best option for watering mature trees is to contact an arborist who can inject water directly into the root system, if needed. In general, mature trees employ a set of defensive actions against drought effects and can endure fairly long periods of dryness so that even during a summer drought only a few supplemental waterings may be needed. Consult a certified arborist to determine the best treatment.

Pruning

Pruning can help minimize the impact of wind and snow loads on trees, reducing the risk of failure. Trees are also pruned to provide clearance or open a view, to maintain historic character, to reduce shade and wind resistance, to maintain health, to influence fruit and flower production, or to improve aesthetics. Generally, it is best to prune during the dormant season to avoid pests and pathogens that may take advantage of a wounded tree, and no more than 25% of the live plant material should be removed during a single season. Some trees, like crabapples and cherries, should be pruned after flowering to avoid impacting later flower production.

An effective pruning regimen begins when a tree is young, with the goal of establishing good structure throughout its life. At planting, pruning should correct structural defects, such as competing leaders, and remove broken or damaged branches. Annual pruning should focus on establishing a good natural form and maintaining spacing between branches. After several years, it will be time to select the lowest scaffold branch and (later) additional scaffold branches. Branches toward the base of the crown should not be larger than one half the diameter of the stem to which they are attached. Larger branches will form weak attachments and may be more likely to fail as the tree grows. Pruning can continue every two to four years through the tree's first 25 years of life. After that, pruning may take place on a less frequent basis, but periodic inspection, especially following storms, should continue. Tree species more prone to storm damage include silver maple (*Acer saccharinum*), willow (*Salix spp.*), paper birch (*Betula papyrifera*), magnolia (*Magnolia spp.*), and beech (*Fagus spp.*).

"When the oak is felled, the whole forest echoes with its fall, but a hundred acorns are sown in silence by an unnoticed breeze."

THOMAS CARLYLE

CASE STUDY: Quabbin Park Cemetery, Ware

In addition to pests such as the Asian longhorned beetle, trees face threats from weather. High temperatures, drought, wind, and snow can stress new plantings and established and mature trees. DCR's Quabbin Park Cemetery was affected by a series of snow and ice storms beginning in 2008. With trees and grave markers vulnerable to damage and a clear risk to the public, DCR undertook a major effort to eliminate hazards. Dozens of trees were pruned, and several unhealthy specimens were removed. The historic landscape is now safer, with healthier, better-looking trees. A replanting project is also planned to restore the more prominent trees.

Pests and Pathogens

It is harder to protect historic trees from pests and pathogens. Exotic pests are often harmful because our trees lack defenses, but even native pests can reach outbreak stages and impact trees. Pests and pathogens in the Commonwealth include newcomers like the Asian longhorned beetle, emerald ash borer, and winter moth, as well as those that have been in Massachusetts for decades like gypsy moth, Dutch elm disease, and forest tent caterpillar (a native insect that periodically becomes problematic). Because many pests and diseases can be devastating, chemical treatment is an option to protect high-value or significant trees from pests confirmed in the area. Treating a persistent threat such as the winter moth or emerald ash borer can be costly, but it can effectively maintain the health and vigor of trees. A certified arborist can help monitor for pests and determine the best course of action to protect trees at risk, including implementation of Integrated Pest Management (IPM) as appropriate (see http://www.umass.edu/umext/ipm/ for more information).

Some of the most iconic street trees in Massachusetts are considered to be good hosts for the Asian longhorned beetle — maple (*Acer*), horse chestnut (*Aesculus*), birch (*Betula*), plane tree (*Platanus*), poplar (*Populus*), willow (*Salix*), and elm (*Ulmus*).

HISTORIC INVADERS

As a record of our past, historic landscapes tell the story of our interaction with the land, including the historic fascination with exotic and non-native plants and their introduction to American gardens. During the 19th century, places like the Arnold Arboretum were importing plants from Asia, and as those cultivars became more readily available, gardeners and landscape architects used them for their color, form, and visual impact. English ivy (*Hedera helix*), Chinese wisteria (*Wisteria sinensis* and other varieties), trumpet vine (*Campsis radicans*), and climbing hydrangea (*Hydrangea petiolaris*) added vertical interest and a lush backdrop to gardens, softening hard-edged architectural elements. However, left unchecked, these plants can spread rapidly to mature trees, weighing heavily on the tree's structure, trapping moisture against bark, and choking out nutrients and light both in the canopy and at root level. A landscape preservation plan should identify significant vines and a means for preservation, including adequate support, root control, and a maintenance program. Substitute plants can be used if historic plants are invasive.

See the state's invasive plant list at www.mass.gov/dfwele/dfw/nhesp/conservation/invasives/invasive_plant_info.htm.

Wisteria in trees

ALB IN MASSACHUSETTS: BACKGROUND

The Asian longhorned beetle (*Anoplophora glabripennis*, often known as ALB) has radically changed the landscape of communities in Worcester County. In 2008, a resident of Worcester found an unusual beetle in her yard, contacted authorities, and within a day the infestation was confirmed. Soon after, the City of Worcester was part of a regulated area under state and federal quarantine, a designation that has expanded to include several more communities. Unlike many exotic invasive pests, ALB cannot be managed, rather it must be eradicated, which is the goal in Massachusetts. The eradication process starts with inspections of all host trees, removal of infested trees, and, eventually, chemical treatment of non-infested trees. The only known method of handling infested trees is complete removal, including the stump, and grinding all tree materials into wood chips.

Since 2009, over 30,000 trees have been removed in the regulated area, and these removals have impacted residential and commercial properties, parks, squares, and forested areas. Tree removals have dramatically changed many neighborhoods, and residents have had to cope with the changes to the character and feel of their streets. In the Worcester area, replanting efforts have been underway to restore lost canopy. Replanting following tree removal requires choosing species that are not susceptible to ALB and adhering to "right tree, right place" principles, ensuring that planted trees will have enough room to grow to their full potential. Replanting efforts have focused on improving species diversity, an important tool in buffering impacts of exotic pests.

ALB IMPACTS ON HISTORIC LANDSCAPES

Worcester and the surrounding communities have many historic landscapes that are at risk from the Asian longhorned beetle, including the grounds of public buildings (libraries, schools, etc.), historic tree-lined streets, parks, and cemeteries. Surprisingly, Worcester's most notable historic landscapes – the Olmsted-designed Elm Park and the iconic Hope Cemetery – have been spared infestation from ALB. The loss of mature trees in such landscapes would have severely impacted the integrity of the property and would have triggered a robust program of replacement planting. In areas where ALB has ravaged the urban forest, the response has been similar. Although lesser known, Dodge Park is one of Worcester's older parks, established in 1889 at the site of a natural spring and local water supply. Later, it became a destination for passive recreation, and by 1897 the park featured a rustic stone bridge and other features. In 2011, all trees in Dodge Park that were susceptible to infestation by ALB were removed, opening up the densely wooded park and exposing some of the historic features. Following eradication, the bridge and stone features were restored, and hundreds of new trees were planted based on historical research to create a public arboretum of diverse specimen trees.

CASE STUDY: Worcester

DCR's Urban and Community Forestry Program has been a key player in restoring the urban forest, which helps define the historic character of neighborhoods across Massachusetts. In Worcester, the Greendale area featured a collection of turn-of-the-century homes and a mature tree canopy provided by maples and other trees on private lots and along the streets. This area was a hot spot for ALB, and all of the trees had to be removed, radically changing the neighborhood. Replacement plantings were provided quickly, but it will be a long time before the neighborhood looks the same.

Greendale Avenue before eradication

Greendale Avenue after eradication, before replanting

Dodge Park after eradication

Mount Wollaston Cemetery, Quincy

The lack of leaves on the upper branches of this tree indicates that the limbs have died and may be a sign of poor tree health. Dead limbs can fall, injuring cemetery visitors and damaging grave markers.

BALANCING PRESERVATION WITH PUBLIC SAFETY

A tree is considered a risk if it has a defect – such as a decaying trunk, dead limbs, or a damaged root system – that may cause it to break apart or fall *and* if there are targets – such as buildings, landscape features, or people – that could be harmed if the tree were to fail. Hazardous trees represent a genuine risk to public safety and must be taken very seriously. Regular inspections and maintenance can help identify and prevent problems before they cause harm, thereby reducing liability concerns. Some trees should be watched especially carefully; large, aging trees pose a greater threat than small, young trees, and certain species have inherently weaker wood, making them particularly susceptible to stress.

For more on recognizing tree hazards, visit www.treesaregood.com/treecare/hazards.aspx.

Sometimes, the only way to address a tree hazard is to remove the tree. But some hazards can be rectified through less aggressive means. Removing large, dead branches and cabling weak crotches may adequately reduce the risk of falling limbs. Installing a lightning protection system may prevent a large tree from being struck and killed. A certified arborist should be consulted to help identify tree hazards and determine the best course of action. When dealing with an individual historic tree or trees within a historic landscape, it is important to explore all options for addressing hazards before taking the most radical course. When total removal is needed, carefully consider an appropriate replacement (see page 14).

Memorial Drive, Cambridge

Although a tree may appear healthy in the upper branches, the trunk is oftentimes weak. This tree trunk along Memorial Drive was originally scarred by cars, and subsequent rot and insect infestation created a major hazard along a busy urban parkway. The tree was removed.

PLANNING FOR THE FUTURE: TREE REMOVAL AND REPLACEMENT

Trees are organic – they grow, mature, decline, and ultimately die. With proper care and maintenance, a tree's death can be delayed, but should nonetheless be planned for as an eventuality. It is especially important to plan an appropriate approach to the removal and replacement of trees that have historic value. Removal techniques should be designed to have minimal impact on other historic features, and decisions about replacement trees should be made from a landscape preservation perspective.

MINIMIZING IMPACTS

Removing a mature tree can be dangerous and should only be undertaken by a professional. In a historic landscape, it is generally best to cut the trunk to grade and either allow it to decay over time or perform limited grinding, not extending beyond the diameter of the trunk. This prevents the disturbance of other landscape features that may be in the vicinity of the tree – such as additional vegetation, turf, walkways, or fences. It also lessens the risk of disturbing archaeological remains located below ground; many historic landscapes are considered "archaeologically sensitive" sites – that is, they have the potential to contain prehistoric or historic artifacts that, if disturbed, could lose much of their historic value. The removal of trees in burial grounds, in particular, must be approached very carefully.

Planting a tree requires digging a hole as large as three times the diameter of the root ball and has the potential to disturb other landscape features and archaeological artifacts. Locating the new tree adjacent to or directly in the same spot as a previous planting may minimize impacts, since the soil has already been disturbed. In any landscape that might be archaeologically sensitive, consult with the archaeological staff at the Massachusetts Historical Commission (MHC) for guidance prior to removing an old tree or planting a new one. If the tree work is part of a project that received a state or federal grant or permit, you may be *required* to consult with the MHC. In that case, MHC staff would review the project to assess its potential impact on any historic resources, archaeological or otherwise. MHC staff can also help determine the sensitivity of the site, if you are unsure.

If, when removing or planting a tree, human remains are discovered, Massachusetts law requires that you cease all work immediately, contact the State Medical Examiner, and if the bones are likely to be 100 years old or older, contact the State Archaeologist (Massachusetts General Laws Chapter 38, Section 6B, and Chapter 9, Section 27C). State Medical Examiner (617) 267-6767; State Archaeologist (617) 727-8470.

"Trees are the best monument that a man can erect to his own memory. They speak in praises without flattery, and they are blessings to children yet unborn."

LORD ORRERY

Longwood Mall, Brookline

Interplanting, or the practice of planting young trees among mature trees, anticipates the loss of older trees and ensures the establishment of new ones. This young European beech has been appropriately placed among the surrounding grove of 175-year-old trees.

SPECIAL CONSIDERATIONS: CEMETERIES AND BURIAL GROUNDS

Removal and replacement of a mature tree in a historic cemetery must be managed carefully to avoid impacts to surrounding burials. More information on managing trees in historic cemeteries may be found in DCR's award-winning *Preservation Guidelines for Municipally Owned Historic Burial Grounds and Cemeteries*, included on CD-Rom inside *Terra Firma #10 – Mourning Glory: Preserving Historic Cemeteries*.

If you have concerns that tree work may affect archaeological remains, contact the State Archaeologist at the Massachusetts Historical Commission (MHC) before work begins.

Photo courtesy of Elder Tree Nursery

Every tree brings a different character to the landscape. The sugar maple (right) is an iconic New England tree that can grow to 100 feet tall, with a full crown and spectacular autumn color. By contrast, the eastern red cedar (far right) is an evergreen with a dense, pyramidal shape, growing to 40–50 feet tall.

CHOOSING APPROPRIATE REPLACEMENT TREES: WHAT'S IN A SPECIES?

Many factors come into play when choosing what type of tree to plant. Trees in dense, urban settings may be selected based on their mature height and maintenance requirements as well as the site's physical constraints and soil quality. Generally, it is best to choose a tree that is appropriate to the existing environmental conditions and the community's maintenance capacity. In a historic landscape, however, additional factors must be considered, since tree types have an enormous impact on a landscape's character. The designer of a historic garden likely chose tree species and varieties specifically for their size, shape, leaves, and flowers, among other factors. The types of trees in landscapes that were not professionally designed may be equally important. For example, a rural road lined with deciduous trees that provide a shady summer canopy, such as white oaks, will have a different quality than a road lined with an upright, coniferous species, such as eastern white pine.

Ideally, decisions about the treatment of historic trees and the selection of appropriate replacement species are made in the context of an overall landscape preservation plan. A thorough plan may specify certain species and varieties of trees for the landscape, perhaps based on historic plans or photographs. Tree selection should be consistent with the recommendations of existing planning documents. If the landscape is municipally owned, the local historical commission should know if a preservation plan has been completed for the landscape.

For information about landscape preservation plans, consult *Preservation Briefs #36: Protecting Cultural Landscapes*, available for free at www.cr.nps.gov/hps/tps/briefs/brief36.htm.

For general information on how to choose a tree, consult the ISA's brochure on tree selection at www.treesaregood.com/treecare/tree_selection.aspx.

"A man does not plant a tree for himself, he plants it for posterity."

ALEXANDER SMITH

Sometimes, it may be necessary to make a decision about a replacement species without the benefit of a landscape preservation plan. In these cases, ask the following questions before making a species selection:

Is the tree to be planted replacing an existing tree? When was the existing tree planted? Is it historic and does it add to the character of the site?

Is the site a designed landscape, laid out according to a specific plan? If so, what type of tree was specified in the plan? If plans do not survive, are there historic photographs of the landscape? Is the historic species and variety still available and appropriate?

Is the site a vernacular landscape (not laid out by a landscape designer or according to a design tradition)? Has the landscape traditionally contained certain species of trees?

In many cases, replacement in kind – that is, planting the same type of tree that was historically planted – is the most appropriate action. But replacement in kind is not always possible, practical, or desirable. The exact variety of tree specified for a formal garden may no longer be readily available. While the town park may once have been planted with just one or two species of trees, it may be best to choose several different types to protect against disease (in the mid-1900s, Dutch elm disease claimed countless American elms throughout the United States). Changing environmental conditions – such as the prevalence of cars, carbon monoxide, and road salt – may warrant use of a hardy species of street tree. It is important to make the best selection from a landscape preservation standpoint, but to balance those considerations with practical factors. A historic landscape architect or a certified arborist can help select appropriate alternatives.

A variety of factors must be considered when choosing appropriate substitute species, with the goal of choosing a replacement species that resembles the historic. Consider the following characteristics before making a final selection:

Size	How tall is the tree when fully grown? How far do its branches extend?
Shape/Form	What is the natural shape of the tree – e.g., pyramidal, full-crowned, vase-shaped, or spreading?
Texture	Is the tree evergreen or deciduous? What shape are its leaves or needles? Does it produce cones?
Color	What color are the leaves or needles? Does the color change according to season? Does the tree produce flowers or berries?

SELECTING NURSERY STOCK

When selecting trees, consider buying local. Native-grown nursery stock is well adapted to the Massachusetts climate and weather patterns and may establish more quickly in your landscape. Select plants that are well-formed; in a moist condition; free from dead wood, root, or branch injuries; and with healthy root systems. Be especially careful to avoid plants with girdling roots. Girdling roots encircle the base of the tree trunk, which may compromise the tree's vascular system and, ultimately, result in death. If detected early in young trees, small (< 2" diam.) girdling roots can be removed by a certified arborist, extending the life of the tree.

Photo courtesy of NPS, Frederick Law Olmsted National Historic Site

CASE STUDY: The Olmsted Elm

Sometimes a historic tree is so significant only a genetic replica will do as a replacement. Cloning historic trees can be successful, but also may present challenges. In March 2011, the National Park Service (NPS) had to remove the iconic elm tree that graced the lawn of Fairstead, home and office of Frederick Law Olmsted, founder of American Landscape architecture. Olmsted moved to Brookline, Massachusetts in 1883 and retained the elm tree in his design for the property. The elm stood over 200 years, until it succumbed to Dutch elm disease, despite numerous treatments and interventions. Because the tree was a significant feature of the historic landscape, the NPS went to great lengths to ensure the tree's return to the property. Through the "Witness Tree Project," students of furniture design at the Rhode Island School of Design created objects related to Fairstead using the wood from the Olmsted elm. Objects were displayed on site in the fall of 2012. In anticipation of the elm's ultimate demise, over the previous decade clippings from the Olmsted elm had been propagated at the Arnold Arboretum in hopes that when healthy seedlings were ready, a genetically identical replacement tree could be planted. Regrettably, the clones produced either failed to thrive or themselves became subject to Dutch elm disease. The NPS is now investigating modern elm cultivars in order to select a replacement tree, seeking one both disease-resistant and likely to produce a mature elm similar in shape to the historic Olmsted elm.

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THE LAST WORD: MAINTENANCE = PRESERVATION

The decline of a significant mature tree in a cultural landscape can be a real threat to its historic integrity and an emotional loss for stewards and visitors. In some cases, like the Olmsted Elm, even extraordinary intervention is not enough to save a tree. However, most mature trees can live for hundreds of years given the right care and maintenance, if that care is part of an integrated management strategy. Landscape managers and advocates devote much of their time and resources to preservation planning, capital improvements, public education, outreach, and other worthy activities. Maintenance is sometimes forgotten or treated simply as a function of daily operations; but maintenance should be planned for, scheduled, and funded in the same way that major preservation projects are. A maintenance plan for mature trees should identify maintenance activities, tie activities to a real calendar or a weekly/monthly schedule, and assign tasks to specific personnel. Those tasks should be incorporated into staff work plans and evaluated each year to recognize those who are doing a good job and to identify areas where staff might need additional training or equipment. The maintenance plan may also need periodic updates to evaluate successes or to reflect changing conditions and management goals. An essential part of the historic landscape, mature trees add to real property value, so a good maintenance program protects the public's investment and preserves a sense of place.

RESOURCES

In addition to those referenced in the text, the following resources provide useful information on the care of historically significant trees.

American Society of Consulting Arborists
(301) 947-0483 • www.asca-consultants.org/
A useful glossary of common terms may be found at www.asca-consultants.org/conresources/terms.cfm.

American Forests
(202) 737-1944 • www.americanforests.org/

Arnold Arboretum
(617) 524-1718 • www.arboretum.harvard.edu/index.html
Freilicher, Mollie, "Tree by Tree, Yard by Yard: Replanting Worcester's Trees," *Arnoldia* 69/1 July 2011.

The Cultural Landscape Foundation
(202) 483-0553 • www.tclf.org

Harvard Forest
(978) 724-3302 • http://harvardforest.fas.harvard.edu/

International Society of Arboriculture
(888) 472-8733 • www.isa-arbor.com/home.asp
Tree care brochures and other information for the general public may be found at www.treesaregood.com.

International Society of Arboriculture — New England Chapter
(978) 844-0441 • http://www.newenglandisa.org/

Massachusetts Arborists Association
(508) 653-3320 • www.massarbor.org/

Massachusetts Department of Agricultural Resources
(617) 626-1720 • http://www.mass.gov/agr/

- Asian Longhorned Beetle Information
  http://www.mass.gov/agr/alb.htm
- Massachusetts Introduced Pest Outreach Project
  (In cooperation with the UMass Extension program)
  http://www.massnrc.org/pests/

Massachusetts Department of Conservation and Recreation
(617) 626-1250

- Bureau of Forestry
  www.mass.gov/dcr/stewardship/forestry/index.htm
- Historic Landscape Preservation Initiative
  www.mass.gov/dcr/stewardship/histland/histland.htm

Massachusetts Division of Fish and Wildlife
Natural Heritage and Endangered Species Program – Invasive Plant Information
(508) 389-6300 • www.mass.gov/dfwele/dfw/nhesp/conservation/invasives/invasive_plant_info.htm

Massachusetts Forest Landowners Association
(413) 549-5900 • www.massforests.org

Massachusetts Tree Wardens and Foresters Association
(413) 533-3346 • http://masstreewardens.org

The National Arbor Day Foundation
(888) 448-7337 • www.arborday.org
Tips on identifying trees may be found at www.arborday.org/trees/treeid.cfm

National Center for Preservation Technology and Training
(318) 356-7444 • http://ncptt.nps.gov/

The National Park Service

- Climate Change and Cultural Landscapes
  http://www.nps.gov/cultural_landscapes/climatechange.html
- Olmsted Center for Landscape Preservation
  (617) 241-6954 • www.nps.gov/oclp/index.htm
- Technical Preservation Services
  (202) 513-7270 • http://www.nps.gov/tps/
- The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes
  http://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/index.htm

United States Department of Agriculture (USDA) Forest Service
(202) 205-8333 • www.fs.fed.us/

USDA Animal and Plant Health Inspection Service (APHIS)
(866) 524-5421 • http://www.aphis.usda.gov/
For information on pest outbreaks and eradication.

University of Massachusetts Extension
Landscape, Nursery and Urban Forestry Program
(413) 545-2685 • http://extension.umass.edu/landscape/

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