NATIONAL MALL JEFFERSON ELM
(National Mall *Ulmus americana* 'Jefferson')
NPS Witness Tree Protection Program
National Mall
Across Jefferson Drive from Freer Gallery of Art
Washington
District of Columbia

HALS DC-7
DC-7

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN LANDSCAPES SURVEY
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

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HALS No. DC-7

Location:	National Mall, across Jefferson Drive from the Freer Gallery of Art, Washington, District of Columbia
Owner/Manager:	U.S. Government, National Park Service
Present Use:	Ornamental and shade tree; biological research specimen
Significance:	The National Mall Jefferson Elm (*Ulmus americana* 'Jefferson') is significant because of its unique disease resist genetic arrangement that has resulted in its longevity in the face of Dutch elm disease. This Jefferson Elm cultivar will help the American elm reestablish itself throughout America's landscapes. The tree is also significant as one of surviving specimens planted in the 1930s according to the McMillan Commission's redesign of the modern National Mall.
Author & Discipline:	Jonathan Pliska, Landscape Architectural Historian, 2006
Project Information:	The Witness Tree Protection Program was a pilot project undertaken by the Historic American Landscapes Survey and the National Capital Region of the National Park Service. The principals involved were Richard O'Connor, Chief, Heritage Documentation Programs; Paul D. Dolinsky, Chief, Historic American Landscapes Survey; Darwina Neal, Chief, Cultural Resources, National Capital Region; Jonathan Pliska, Historian, Historic American Landscapes Survey; Jet Lowe and James Rosenthal, Photographers, Heritage Documentation Programs.

PART I. HISTORICAL INFORMATION

Bounded by 15th Street to the west, Constitution Avenue and Pennsylvania Avenue to the north, the foot of the U.S. Capitol to the east, and Independence Avenue and Maryland Avenue to the south, the National Mall ranks amongst the most important and easily recognizable expanses of green space in the United States. Pierre Charles L'Enfant included the Mall in his original 1791 design for the city of Washington. His vision was that of a "Grand Avenue," approximately one mile long and 400' wide, lined with trees

and bordered by gardens, federal buildings, and the houses of diplomats.[1] However, by 1812 this public land remained unimproved, utilized primarily for livestock grazing and storage, and occasionally as a site for fairs and circuses.[2] In the same year, Congress passed an act authorizing private lease of the land, and in 1817 actually sold off four parcels to private developers.[3] Capitol Hill resident John Law lamented the utter lack of improvements to the Mall, stating in 1820, "not a tree has been planted, not even a common fence encloses it."[4]

Although some improvements had been carried out on the Mall by the mid-nineteenth century, including the planting of 200-300 "thrifty young trees" on the grounds of the Smithsonian Institution Building, the outbreak of the Civil War effectively prevented any additional work from taking place. Moreover, as with nearly all public lands in the Districts of Columbia, the Mall was used for billeting troops and as a bivouac area.[5] As troop encampments, barracks, hospitals, and other crude buildings were constructed, those improvements already in place were largely neglected or destroyed.[6] Moreover, the canal running along the north side of the Mall (built 1802-17) was poorly constructed, flooded frequently, and was in desperate need of repairs. Included in L'Enfant's 1791 plan and envisioned by George Washington as a commercial thoroughfare, the canal's foul smell instead discouraged development and constituted a public health hazard. In 1864, Public Buildings Commissioner Benjamin B. French condemned it as the "grand receptacle of nearly all of the filth of the city."[7] By the end of the Civil War, seventy-three years had passed since the federal government acquired the land comprising the National Mall. Far from the grand public park originally envisioned, it emerged as a treeless expanse marked by minimal improvements, crude military buildings, and a decrepit canal clogged with waste.

In the coming decades, the National Mall was transformed into a public open space much more in keeping with its proponents' original vision. From 1871-73, the District's short-lived territorial government planted thousands of trees, many of which were located on the Mall.[8] The much-maligned canal was converted into an underground sewer, with a roadway, later named Constitution Avenue, created along its path. By 1878, the area

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[1] Elizabeth Barthold, "The National Mall and Monument Grounds," HABS No. DC-678 (Washington, D.C.: Historic American Buildings Survey (HABS), 1993), 4.
[2] Ibid, 6.
[3] Pamela Scott, "'This Vast Empire': The Iconography of the Mall, 1791-1848, in *The Mall in Washington, 1791-1991*, ed. Richard Longstreth (Hanover, N.H.: University Press of New England, 1991), 46.
[4] *Ceremonies and Oration at Laying the Cornerstone of the City Hall of the City of Washington, August 22, 1820*, (Washington: Jacob Gideon Jr., 1820), quoted in Daniel D. Reiff, *Washington Architecture 1991-1861: Problems in Development* (Washington, D.C.: U.S. Commission of Fine Arts and Government Printing Office, 1971), 30.
[5] George J. Olszewski, "History of the Mall: Washington, D.C.," U.S. Department of the Interior, National Park Service, Eastern Service Center, Office of History and Historic Architecture, Washington, D.C.: 1970, 23.
[6] Barthold, 11.
[7] Benjamin B. French, *Annual Report of the Commission of Public Builds and Grounds*, 1864, 687, quoted in Barthold, 11.
[8] Barthold, 12.

between 6th and 3rd streets alone contained an estimated 860 evergreens, deciduous trees, and shrubs. According to official records, "much of the Mall was graded, sodded, planted with trees and shrubs, intersected with roads and paths, and supplied with water and gas."[9] Beginning with the 1868 construction of the first U.S. Dept. of Agriculture building on the south side of the Mall, this period also witnessed several major building projects, including the 1871-73 erection of the Baltimore and Potomac Railroad Depot, the National Museum (now the Smithsonian's Arts and Industries Building) in 1878, and the U.S. Army Medical Museum and Library in 1887. With the construction of these buildings and the removal of the repulsive canal, the Mall quickly began to attract visitors.[10]

However, since roadways divided the Mall into various segments, each of which was individually improved as buildings were constructed, it came to be regarded more as a string of individual parks than one continuous greenway.[11] Indeed, the sweeping public parkland that occupies the National Mall today is largely a twentieth-century creation, and a product of the 1901 McMillan Commission. Chaired by Michigan Sen. James McMillan, this illustrious group consisted of Daniel H. Burnham, director of the 1893 World's Columbian Exposition, landscape architect Frederick Law Olmstead, Jr., architect Charles F. McKim, and sculptor Augustus Saint-Gaudens.[12] The commission members envisioned a return to L'Enfant's Grand Avenue, calling for an open, grassy vista leading to the Capitol, flanked by four rows of American elm trees separated lengthwise and crosswise by 50'.[13] They used the term "tapis-vert," French for green carpet, to describe this design, and explained that the American elm was chosen "not only because of the architectural character of its columnar trunk and the delicate traceries formed by its widespreading branches, but also because in the District of Columbia this tree is at its best, notable examples being found in the city parks and in the grounds of the Capitol."[14] The commission scored a major victory with the 1907 demolition of the Baltimore and Potomac Railroad Station, but during World War I the Mall again accommodated a bevy of temporary military structures. As a result, initial tree plantings in line with the tapis-vert model did not begin until 1921, and on the whole little progress was made on the Mall toward the realization of the McMillan Plan until 1934, when the numerous parcels were consolidated under the management of the newly created National Park Service.[15]

That same year, the removal of Maine and Missouri avenues from the Mall finally created the unbroken vista envisioned by the McMillan Commission, and by 1936 the

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[9] *Annual Report of the Commission of Public Builds and Grounds*, 1878, quoted in Barthold, 14.
[10] Barthold, 15.
[11] Ibid, 9.
[12] After McMillan's death in 1902, his assistant, and the Commission's Secretary, Charles Moore succeeded him as Chairman.
[13] Charles Moore, *Daniel H. Burnham*, 2 vols. (Boston: Houghton Mifflin Co., 1921), 223.
[14] Senate Committee on the District of Columbia, *Report of the Senate Committee on the District of Columbia on the Improvement of the Park System of the District of Columbia*, 57th Cong., 1st sess., ed. Charles Moore, 1902, Senate Report 166, 45.
[15] Barthold, 19.

north and south edges of the Mall were planted with 333 American elms in four parallel rows. National Park Service horticulturists predicted that upon reaching maturity the elm trees would "provide an elm grove unsurpassed in the entire world for beauty and excellence."[16] The National Mall Jefferson Elm was among these trees purchased from the Connecticut based Leissler's Nursery, and was likely planted sometime during the summer of 1935. Additional American elms, from the Rockville, Maryland, Adolph Gude and Sons Nursery, largely completed the design by 1937. In total, some 600 American elms were planted on Mall in the 1930s. To this day the NPS maintains the National Mall in accordance with the commission's recommendations, preserving both the tapis-vert and its tree-lined borders. Subsequent developments, including the Hirshhorn Gallery (1974), National Air and Space Museum (1976), and National Museum of the American Indian (2004), have been located to the north and south of the Mall, along Constitution Avenue and Independence Avenue respectively, in keeping with the plan for a central greensward. Although many of the original American elms planted during the 1930s have since died and been replaced, the National Mall Jefferson Elm and its fellow survivors recall the time when L'Enfant's vision was finally realized, nearly one-and-a-half centuries later, by the McMillan Commission.

PART II. BIOLOGICAL INFORMATION

Commonly known as the American elm,[17] *Ulmus americana* is one of about eighteen species within the genus *Ulmus* classified under the family Ulmaceae.[18] In 1964, G. H. Collingwood and Warren D. Brush, of the American Forestry Association, praised the tree, saying that, "In summer American elm combines grace and dignity with exceptional beauty, while in winter it reveals the strength of its limbs and branches above a sturdy trunk."[19] This acclaim stems from the same characteristic that has made *Ulmus americana* a favorite street tree throughout much of the United States, namely its unique, easily recognizable, vaselike crown. Most often identified by this overall habit, the tree's leaves, bark, flowers, and fruits are much less conspicuous. The ovate-oblong, deciduous leaves are dark green in color during temperate months and turn a showy, but typical, yellow in the autumn before falling in the winter. Arranged alternately on branches, they are of average size, 3" to 6" long x 1" to 3" wide. Lateral veins branch off on either side from the central vein, or midrib, and the margins are doubly serrated. The base of each leaf is uneven, with either the left or right side extending further down the petiole, or stem. This asymmetrical arrangement, more than any other feature, aids in identifying American elm leaves, although it is far from unique to this species.[20] Likewise, the bark is a muted gray color, with furrows and ridges reminiscent of many oaks. Flowers bloom

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[16] U.S. Dept. of the Interior, "Memorandum for the Press," 4 October 1936, 3, quoted in Olszewski, 89.
[17] Also known as the white elm, water elm, soft elm, swamp elm, and Florida elm.
[18] Liberty Hyde Bailey and Ethyl Hyde Bailey, "*Ulmus*," in *Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada*, revised and expanded by the staff of the Liberty Hyde Bailey Hortorium, Cornell University (New York: Macmillan Publishing Co., Inc., 1976), 1137.
[19] G. H. Collingwood and Warren D. Brush, *Knowing Your Trees*, ed. Devereux Butcher (Washington, D.C.: The American Forestry Association, 1964), 238.
[20] Michael A. Dirr, *Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses*, 5th ed. (Champaign, Ill.: Stipes Publishing L.L.C., 1998) ,1034.

two to three weeks before the leave flush in the spring, and may appear as early as February in the southern extent of the range and as late as May in the north. They are perfect, meaning that each flower is hermaphroditic, containing both male (stamen) and female (pistil) sexual organs. The anther, the pollen-bearing part of the stamen, is bright red, while the pistil and ovary are light green in color. Individual flowers are minute, emerging at the end of 1" long, slender, drooping pedicels (stems). Approximately three to four pedicels are arranged together in close bundles known as fascicles. Pollination is wind-borne, and soon thereafter the fruit ripens in the ovary.[21] Individual fruits are hard, green, round, and typically less than 1" in diameter.[22] They are known as samaras, and these winged fruits are easily dispersed by wind action. Yearly seed dispersal is usually complete by mid-March in the south and mid-June in the north. Trees as young as fifteen years of age may bear seeds, but production is seldom abundant before age forty. Research indicates that American elm may reproduce late into maturity, with trees as old as 300 years reportedly bearing seeds.[23]

Ulmus americana exhibits an extremely fast growth rate, often adding 3' or more of vertical growth in a single year.[24] Most trees reach heights of 60' to 80', but some individuals have grown to 140'. In most open-grown trees the main trunk divides at 10' or 20' to form the distinctive vaselike crown, while in the forest the trunk may grow to 60' before branching. These crown spreads typically measure one-half to two-thirds the height of the tree. At 2' to 4' across, most trunk diameters are relatively small, although the largest may reach 11'.[25] The National Mall Jefferson Elm has not yet reached this upper size range. Additionally, as it was planted on the Mall ca.1935, the tree is approximately seventy-one years old. With an expected natural longevity of at least 150 years, it is physiologically mature but not chronologically old.

Regrettably, since its 1928 introduction from Europe into the United States, Dutch elm disease has devastated the country's American elms. The disease is caused by three strains of the micro-fungi *Ophiostoma ulmi*, and is spread by the European elm bark beetle (*Scolytus* multistriatus) and the native elm bark beetle (*Hylurgopinus rufipes*). An infected American elm responds by blocking its vascular cambium in order to prevent the fungus from spreading further. However, this plug prevents the cambium from delivering water and nutrients throughout the tree, and the diseased elm eventually dies. Often the process is slow, beginning with the withering and dieback of upper branches, and may

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[21] Calvin F. Bay, "American Elm," in *Silvics of North America: 2. Hardwoods. Agricultural Handbook 654*, online ed., tech. coords. Russell M. Burns and Barbara H. Honkala (Washington, D.C.: U.S. Dept. of Agriculture, U.S. Forest Service, 1990), 1538, http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/silvics_v2.pdf (accessed 13 June 2006).
[22] Edward F. Gilman and Dennis G. Watson, Ulmus americana: *American Elm* (Gainsville, Fla.: University of Florida, Institute of Food and Agricultural Sciences, November 1993), http://edis.ifas.ufl.edu/ST649 (accessed 12 June 2006).
[23] Bay, 1538-39.
[24] Jeffery L. Reimer and Walter Mark, *SelecTree: A Tree Selection Guide* (San Luis Obispo, Calif.: Urban Forest Ecosystems Institute, 2004), California Polytechnic State University, http://selectree.calpoly.edu (accessed 21 June 2006).
[25] Collingwood and Brush, 38; Dirr, 1034.

take several years to completely kill a tree. Although Dutch elm disease can be managed through intensive sanitation, many municipalities lack the money or expertise necessary to carry out such programs.[26] Consequently, the disease has destroyed many of the grand specimens planted in the eighteenth and nineteenth centuries, and killed off scores of younger trees well before they reached 150 years of age. Because of the widespread popularity of *Ulmus americana* in landscape design, the death of several million trees has had an extremely deleterious effect on neighborhoods across America.

Shortly after the disease arrived in the United States, research into resistant substitutes began. Trees of the genus *Zelkova* are closely related to elms, similar in size, and exhibit comparable vase-like branching habits, but do not suffer from Dutch elm disease. While occasionally planted as elm replacements, they remain rare and are considered less desirable than *Ulmus americana*. Likewise, Asiatic and European elms are unaffected by the disease and have long been available as substitutes, but are generally much smaller and squatter than the American elm. More recently, hybridization programs have sought to combine genes from these trees with those of *Ulmus americana* in order to breed disease-resistant specimens. Although scientists have succeeded in developing a number of Dutch elm disease resistant selections, they recognize that "most do not have the desirable tall, umbrella form characteristic of the American elm."[27] Consequently, these hybrids have not been widely accepted, and there has been a great desire to locate and propagate individual specimens of *Ulmus americana* that have demonstrated resistance to Dutch elm disease. In order to build up populations of resistant trees, genetically identical offspring are grown from seeds produced via self-pollination or vegetative cuttings taken from the parent. The first such American elm cultivar (cultivated variety) was the Princeton elm, selected in 1922 by Princeton Nurseries because of its attractive upright form. For over seventy years the nursery marketed the cultivar solely for its landscape value, until U.S. Department of Agriculture (USDA) tests carried out in the 1990s revealed its disease resistance. Additionally, in 1957 the University of Wisconsin began an extensive disease-resistant breeding program that culminated in the early 1980s with the commercial release of five cultivars known collectively as the American Liberty elms. The USDA followed with the release of two additional cultivars, New Harmony and Valley Forge, in the 1990s.

Dutch elm disease first occurred on the National Mall in 1950, and by 1994 had claimed over 200 trees. Around this time, Horace V. Wester, a former plant pathologist with the National Park Service, National Capital Region, recognized several American elms on the Mall that developed leaves earlier than surrounding trees and retained their foliage later in the fall. He hypothesized that this extended period of foliation might indicate unusually vigorous specimens and possible resistance to Dutch elm disease.[28] One of the trees exhibiting these characteristics was NPS 3-487, the National Mall Jefferson Elm,

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[26] James L. Sherald, Frank S. Santamour Jr., Ravindra K. Hajela, Neerja Hajela, and Mariam B. Strickland, "A Dutch Elm Disease Resistant Triploid Elm," *Canadian Journal of Forest Research* 24; no. 4 (1994): 647.
[27] Ibid.
[28] Ibid., 648.

whose leaves remain green through late-October, while most of the approximately 600 neighboring elms begin losing leaves by early-October. Throughout the 1980s and early 1990s James L. Sherald, Chief of Natural Resources and Science for the National Capital Region of the National Park Service, led scientists from the National Park Service Center for Urban Ecology, U.S. National Arboretum, and Michigan State University Department of Crop and Soil Science in conducting experiments on trees grown as softwood cuttings from the Jefferson Elm. The group's findings proved that the tree was indeed resistant to Dutch elm disease. When inoculated with *Ophiostoma ulmi* none of the cuttings developed systemic wilt (zero percent) compared with eight of eighteen wild-type American elms also tested (forty-four percent). As reported by the scientists, attempts to grow Jefferson Elm progeny from seeds proved unsuccessful. Specimens grown in this manner experienced "low viability and seedlings were highly variable in height, leaf size, and shape."[29]

In conducting DNA analyses, the group discovered that the Jefferson Elm is triploid, meaning that its cells contain three sets of each of its fourteen chromosomes for a total of forty-two. This find is remarkable given that American elms are naturally tetraploid (four sets totaling fifty-six chromosomes), and all other elms are diploid (two sets totaling twenty-eight chromosomes). While unclear exactly how, it is believed that this unique genetic arrangement has led to the Jefferson elm's resistance to Dutch elm disease and its inability to effectively reproduce via seeds, as well as several other unique characteristics. These include a lighter than average bark color, significantly larger leaf buds, and U-shaped versus V-shaped branch crotches. A great deal of stress is borne at each crotch, the point where a branch meets the trunk, and the U-shaped junction provides a stronger means of attachment. Therefore, while the Jefferson Elm's primary biological significance is its resistance to Dutch elm disease, it also benefits from a superior branching structure. In February 2005, the National Park Service and the U.S. Department of Agriculture jointly released the Jefferson Elm cultivar to the commercial nursery trade, so named by Sherald because of the original tree's proximity to Jefferson Drive. While he is optimistic that this new cultivar will help the American elm reestablish itself throughout America's landscapes, he cautions against relying solely on any one cultivar: "Since 'Jefferson' may eventually become susceptible to a new strain of the pathogen that causes Dutch elm disease or some other disease or insect infestation, the National Park Service will never rely exclusively on 'Jefferson' or any single cultivar in its forest care. Instead, park managers will continue to diversify the population with new resistant selections as they become available."[30] Today, the original National Mall Jefferson Elm is in good condition, free of significant damage from disease, pests, or the extensive public use of the National Mall.

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[29] Ibid., 647.
[30] James L. Sherald, "Disease-resistant American Elm to Return to the National Mall," in *NPS Natural Resource Year in Review*, 2005.