National Park Service
U.S. Department of the Interior

clippings

Concepts and Techniques for Maintaining Cultural Landscapes

IN THIS ISSUE

Replacing Trees in Cultural Landscapes

Trees in cultural landscapes are living resources that have determinate life spans. Similar to other living organisms, trees progress through juvenile, mature and senescent stages. Eventually, even with the best of care, they will inevitably deteriorate and die. Field conservation techniques can extend the lifespan of individual trees, but, ultimately specimens will need to be removed from the landscape.

As tree condition deteriorates, structural instability and associated issues of potential failure and safety become more prevalent. Trees that present hazardous situations or no longer effectively contribute to the desired character of a cultural landscape need to be removed and replaced.

Removing and replacing a tree, especially a large older specimen, can be a very invasive procedure. Oftentimes, heavy equipment is needed to cut, dig, pull and haul materials to and from the work site. These activities often cause major disturbance to the landscape. Irreversible damage to important archeological resources, adjacent historic plants, and other important features can occur. In a cultural landscape, these adjacent resources may be irreplaceable or extremely costly to repair. Field techniques that effectively integrate traditional horticulture practice with preservation objectives can ensure that important resources are protected and landscape character is preserved over time.

This publication provides guidance on replacing trees in cultural landscapes using methods that respect the sensitivity and importance of the site and its features. Information is provided sequentially, beginning with removing a tree stump, continuing with procedures for planting a replacement as close to the original location as possible and concluding with a record keeping system to document work accomplished. The goal of these recommendations is to help guide field practices that minimize adverse impacts to the site, prevent damage to important resources and protect the character and integrity of the cultural landscape.

REMOVING A TREE STUMP

When replacing a tree in a cultural landscape, it is often important to plant the new tree as close as possible to the location of the original. By doing so, the historic design and landscape character can be effectively perpetuated. Before replanting, the remaining tree stump must first be removed. This procedure can cause significant damage to the site, archeological resources and adjacent features such as historic plants and structures. When determining the best alternative to use, it is important to consider the vulnerability of adjacent resources, site constraints, landscape management goals and the feasibility of implementation.

Considerations:

1. Site Management

- Is the stump in a location that could cause a safety hazard? If so, does it need to be removed quickly or would a slower method be acceptable?
- How soon after stump removal does a replacement tree need to be replanted?
- Will the removal and replacement procedures adversely affect or impede other site activities such as visitor access, special events, etc.?

2. Proximity of Resources

- Are there archeological resources that need to be studied or documented before disturbing the soil?
- How close are other important resources such as plantings, built landscape features (walls, fences, walkways, sculpture, etc.), structures, roads, etc?
- Can adjacent historic resources be protected during the stump removal process? If damage occurs to adjacent resources can effective repairs be made?

3. Feasibility of Implementation

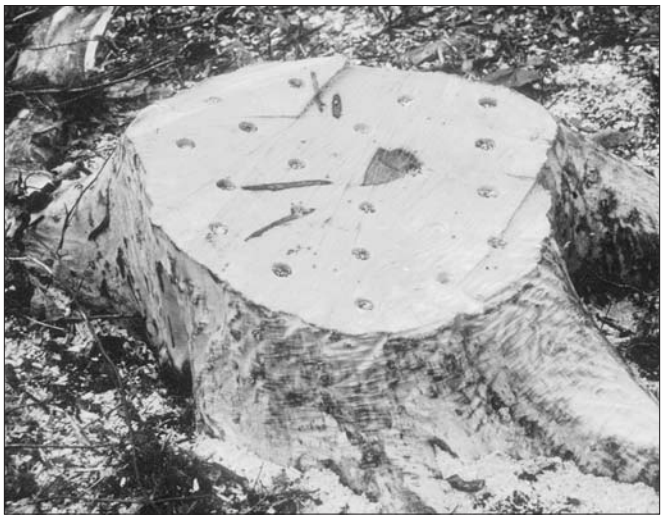
- Is there adequate funding and staffing to accomplish the project?
- Is the needed equipment locally available?
- Is there adequate space available to access the project area and effectively maneuver equipment? How susceptible is the site to equipment damage such as soil compaction or ground disturbance?
- Are there any underground utilities that could be damaged during the process?

PROMOTING A STUMP TO DECAY

Encouraging a stump to decompose is the least invasive method for removal; it is highly localized and causes negligible disturbance to the surrounding area. Because it causes very little ground disturbance, this technique is ideal for removing stumps that are in landscapes with rich archeological resources or other significant features that are susceptible to damage. The process can take 12 to 36 months to be effective, depending on the tree species and local conditions, so, it is best for situations where immediate replanting is not necessary.

Procedures:

- Flush cut the tree trunk as close to the ground as possible and remove bark from the stump.
- Drill a series of holes 3/4 inch to 1 inch in diameter, 6 inches deep and 2 to 3 inches apart into the stump.
- Fill holes with a mixture of 1 part screened compost, 1 part screened topsoil, and 1 part slow release organic high-nitrogen fertilizer such as feather-meal or cottonseed-meal.
- Keep the stump moistened during dry periods and re-fill holes as needed with compost/soil/nitrogen mix.



Promoting decomposition is ideal for removing stumps where site disturbance must be avoided to protect fragile resources.

- Within 12 to 36 months, the stump should be adequately decayed to remove remaining material with hand tools. After removal, backfill the hole with soil that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible.

GRINDING A STUMP

A stump grinder can quickly remove an existing stump and cause limited disturbance to adjacent resources. The operator uses the equipment to remove the tree stump and large roots to a desired depth. The machine's range of motion is not precise enough to follow the exact outline of a stump and will result in some adjacent ground disturbance. This can result in damage to archaeological features or roots of nearby plants. Using a stump grinder is best for situations that require immediate replanting and in locations where important resources are not directly adjacent to the worksite.

Using a grinder to remove tree stumps causes minimal site disturbance and allows replanting in the same location.

Procedures:

- Determine if there are any adjacent resources that may be adversely impacted by the use of the equipment.
- Select the smallest equipment possible that will remove the stump to the desired depth. If immediate re-planting is necessary, the depth of the ground stump should be at least six inches more than the height of the replacement plant root ball to allow for adequate backfilling of the planting hole.
- Protect adjacent plants by tying back branches and placing guards, such as plywood sheets, against nearby tree trunks to shield them from possible damage.
- Lay 1 inch plywood sheets or construction matting on the ground where the machine will be operated to minimize soil disturbance and compaction. A double layer of sheeting laid in a criss-cross pattern provides the best protection. In addition, lay planking or matting on the soil along the route the equipment will use to gain access to the work site.
- Grind the stump to a width and depth necessary to plant a replacement. Remove resulting wood chips and debris using hand tools.
- Backfill the hole with soil that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible.

EXTRACTING A STUMP WITH A TREE SPADE

A tree spade uses hydraulically driven blades that cut through the ground to form and extract a core of soil, stump and roots. While the mechanical action of a tree spade is highly localized and causes minimal site disturbance, the equipment is usually large and can remove a substantial volume of soil. As a result, soil compaction, damage to nearby plantings and loss of archeological resources can occur. Use this method in areas where there are no significant archeological resources and there is adequate space for the equipment to access and maneuver within the site.

Procedures:

- Determine if there are any adjacent resources that may be adversely impacted by the use of the equipment.
- Select the smallest tree spade that can effectively remove the stump. The lifting capacity of the equipment needs to be adequate to pull the stump from the ground.
- Protect adjacent resources by tying back branches of plants and placing guards, such as 1 inch plywood sheets, against nearby tree trunks and structures to shield them from possible damage.
- Lay 1 inch plywood sheets or construction matting on the ground where the machine will be operated to minimize soil disturbance and compaction. A double layer of sheeting laid in a criss-cross pattern provides the best protection. In addition, lay planking or matting on the soil along the route the equipment will use to gain access to the work site.

A tree spade can be used to remove stumps in locations where the use of larger equipment will not damage resources.

- Adjust blades to be as close to the stump as possible for removal. Localizing the mechanical action close to the stump will result in less damage to the surrounding area.
- Extract the stump and soil core and remove from the site. Backfill the hole with soil that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible.

EXCAVATING A STUMP WITH A BACKHOE

Using a backhoe requires substantial digging around and under a stump in order to remove it. This causes significant disturbance to the site and can result in extensive damage to adjacent archeological resources, structures and plants. Only use this method where there is at least fifteen feet clearance from the work site to the nearest resource that could be damaged.

Procedures:

- Determine if there are any adjacent resources that may be adversely impacted by the use of the equipment.
- Select the smallest backhoe that can effectively remove the stump. The equipment must be large enough to dig around and under the stump (a 3 foot diameter stump may extend 4 or 5 feet down into the ground). In addition, the lifting capacity of the equipment needs to be adequate to pull the stump from the ground.
- Protect adjacent resources by tying back branches of plants and placing guards, such as 1 inch plywood sheets, against nearby tree trunks and structures to shield them from possible damage.
- Lay 1 inch plywood sheets or construction matting on the ground where the machine will be operated to minimize soil disturbance and compaction. A double layer of sheeting laid in a criss-cross pattern provides the best protection. In addition, lay planking or matting on the soil along the route the equipment will use to gain access to the work site.
- Use the backhoe to excavate a 2 foot wide trench around the stump. The trench should be deep enough to under cut the stump with the backhoe, typically this will be at least 1.5 times the diameter of the stump. For example a 2 foot diameter stump would typically require at least a 3 foot deep trench to successfully undercut.
- Use a hand or chain saw to cut large roots (2 inches in diameter or larger) as they are exposed by the digging.
- Using chains, slings or other rigging devices, pull the stump from the excavated hole and remove from site. Back fill hole and regrade area with soil that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible.

Use of a backhoe to remove a tree stump can cause significant site disturbance and should be used only in locations where adjacent resources can be well protected.

REPLANTING A TREE

Replacing trees that have been removed from cultural landscapes is an important part of preserving historic character. The procedures used to replant trees, however, if not carefully planned, can be disruptive and damaging to resources adjacent to the planting site.

Selecting planting techniques for replacing trees in cultural landscapes begins with considering many of the same factors used in choosing procedures for stump removal. For example, are there fragile resources near the planting site that will limit equipment access; will the planting process impede other site activities; and, is there adequate funding available to replace the plant using the desired procedure?

Considerations:

1. Site Management

- Do current planning and preservation objectives support the replacement of the tree?
- Does replacement of the tree support contemporary use and activities at the site?

2. Planting Location

- What size does the replacement tree need to be?
- Will preparing the planting hole require moving soil where it has not been previously disturbed?
- Has the stump and root system been adequately removed to prepare for planting a replacement?
- Since the removal of the original plant, have there been any changes to the site or environment that may adversely affect the replacement tree?
- Is there adequate light exposure, water for irrigation and space for the replacement tree to establish and grow?
- Did the previously removed tree have a root disease that could infect the replacement tree?
- Will the newly planted tree require staking or guying that could impede site circulation or activities?

3. Feasibility of Implementation

- Is there adequate funding and staffing to replace and maintain the replacement tree?
- Are there nursery sources available for the replacement plant or is it a unique type that is not commercially available?
- Are there any local, state or federal policies regarding the particular species to be planted?

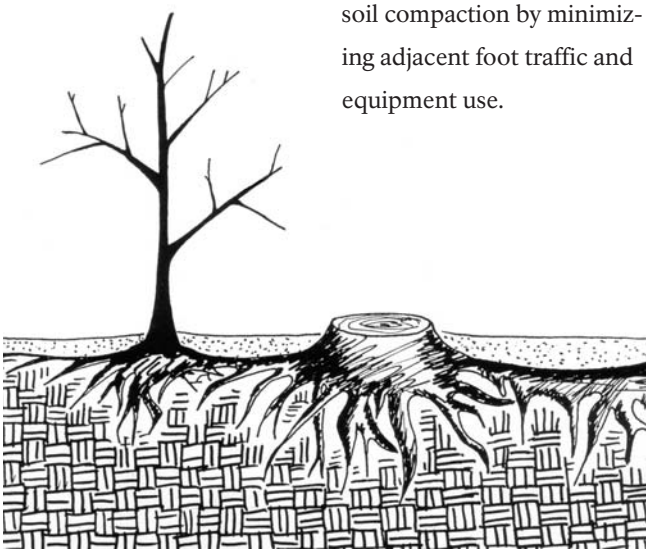
Using a horse drawn wagon to move a large tree for planting, c. 1860.

ROOT SPROUT

Encouraging growth of a healthy root sprout can be an ideal strategy for replacing deteriorated historic trees. The procedure retains the genetic authenticity of the original plant and requires no soil or site disturbance to implement. Before implementing this strategy, determine that the tree is not a grafted specimen. A tree that has been grafted will have a root system that is genetically different from the rest of the plant. A root sprout from a grafted tree may grow to be a completely different plant than desired. Grafted trees can often be determined by an enlarged "graft union" at the base of the trunk.

Procedures:

- Select a vigorous root sprout that has strong growth characteristics and is well anchored into the soil and connecting root system of the original tree. If possible, allow the original tree to remain in place until the root sprout is well established. This may take 2 to 4 years.
- After removing the original tree, allow the stump to remain and naturally decompose. Removal of the stump may cause damage to the root sprout.
- Mulch around the base of the root sprout to prevent weeds from growing and competing with the root sprout and to maintain soil moisture for optimum growth. Keep mulch 6 to 12 inches away from the trunk and bark of the root sprout.
- Protect the root sprout from problems associated with soil compaction by minimizing adjacent foot traffic and equipment use.



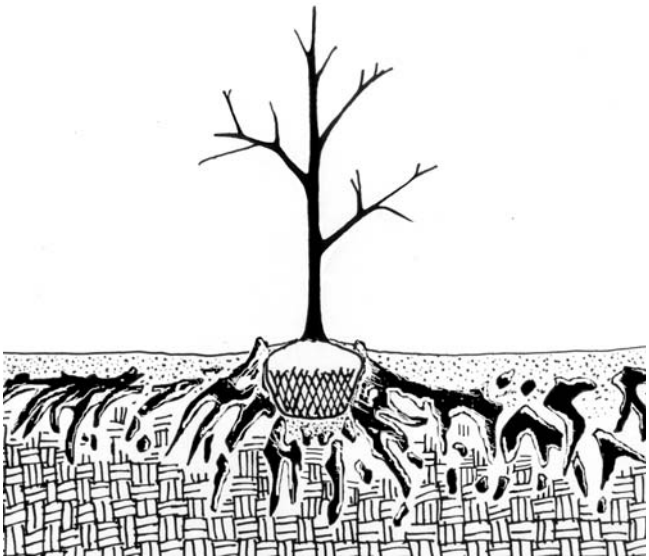
Encouraging the growth of a root sprout is ideal for replacing a tree in locations where site disturbance must be avoided.

PLANTING INTO A DECAYED STUMP

A tree can often be replanted in the location of a decayed stump. This can be an ideal method for replacing trees in areas that have rich archeological resources because it causes very minimal site disturbance. Replacement plants with small rootballs are best suited for this approach because preparation of a smaller hole is needed for planting.

Procedures:

- Assess the extent of decay within the stump. Replanting in the same location will only be effective if the decomposition is well advanced.
- Select the smallest acceptable plant size for replacement. The rootball must be small enough to fit into the decomposed area of the stump with at least 6 to 8 inches of additional space around the roots to backfill with soil.
- Using hand tools, break up and remove the decayed wood remaining from the stump. Create adequate space for planting the rootball and backfilling with soil.
- When planting, elevate the top 2 to 3 inches of the rootball above the surrounding grade.
- Backfill the hole with soil that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible.



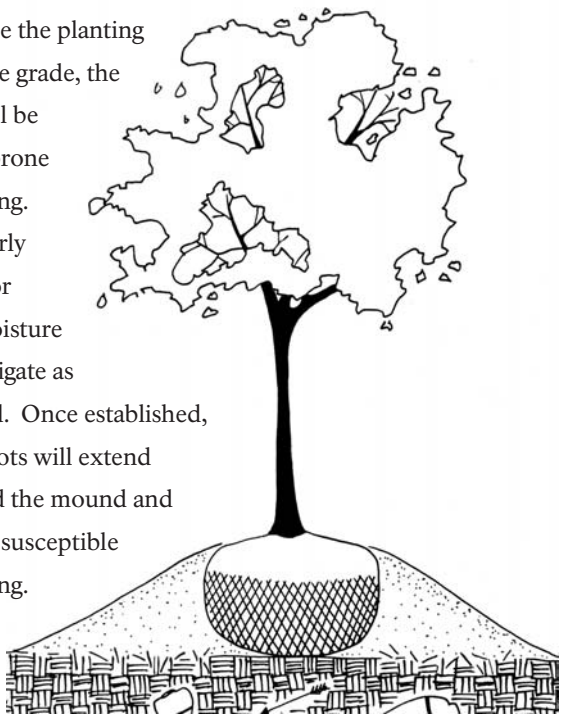
Planting in the same location as a decayed stump allows replacing trees in the exact location as the original.

MOUND PLANTING

Mound planting can be a very effective method for replacing a tree where it is necessary to minimize ground disturbance. This technique mounds soil around a root ball that is placed on the existing grade. The method does not affect underground resources, such as archeological materials or roots of adjacent plants; however, it alters site grading and can change the visual character of the landscape. It is best to use replacement plants with small root balls in order to reduce the amount of soil mounding needed for planting.

Procedures:

- Using a rake, scarify the parent soil to a depth of 2 inches.
- Place tree so that its rootball rests solidly on the ground and the trunk stands upright.
- Mound soil around rootball using fill that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible.
- Taper the mound into the surrounding grade a minimum distance of five times the width of the rootball. Using a replacement tree with the smallest acceptable rootball will minimize the size of the mound required. Mulch to prevent soil erosion.
- Because the planting is above grade, the soil will be more prone to drying. Regularly monitor soil moisture and irrigate as needed. Once established, tree roots will extend beyond the mound and be less susceptible to drying.



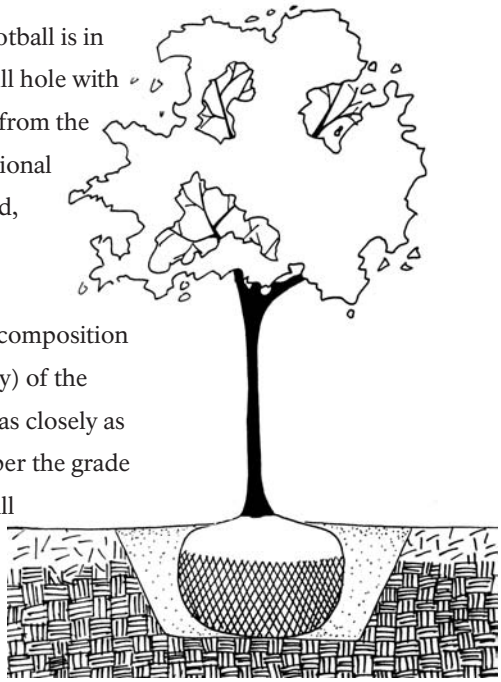
Mound planting is highly effective to minimize disturbance of archeological resources or roots of adjacent plants.

REDUCED TREE PIT

Preparing a smaller planting hole causes less disturbance to the site and adjacent resources as compared to the damage that can be caused by digging a larger planting pit. Traditional horticultural recommendations for planting a tree involve preparing a bowl shaped hole 2 to 3 inches shallower than the depth of the rootball and 3 to 5 times the width of the rootball to be planted. This approach, while good for the plant, can cause significant soil disturbance that damages archeological features, nearby plants, and other adjacent cultural resources. Preparing a planting hole with a reduced width combined with the traditional horticultural recommended bowl shape and shallow depth can significantly reduce disturbance to the site and adjacent cultural resources. Use this method when planting within the root zones of other important vegetation or where the preparation of a larger planting hole would damage adjacent resources.

Procedures:

- Select a replacement tree with the smallest acceptable rootball size.
- Prepare the planting site by digging a hole twice the width of the rootball at the grade surface, tapered slightly to the hole bottom in a bowl-like shape. The depth of the hole should allow for 2 to 3 inches of the top of the rootball to extend above the surrounding grade.
- Once the rootball is in place, backfill hole with original soil from the site. If additional soil is needed, use fill that matches the texture and composition (sand:silt:clay) of the original soil as closely as possible. Taper the grade of the backfill soil to the top of the rootball.



Reducing the size of the planting hole can help protect adjacent resources.

field notes

In most Olmsted designs, mature trees serve a vital role in establishing the landscape's character. When initially constructed, large trees were often transplanted from other locations in order to create a landscape where the design intent was immediately achieved with sizeable plants.

Transplanting large trees, as practiced by the Olmsted firm, required extensive excavation in order to retain and protect as many existing roots as possible and ensure survival of the tree. Nevertheless, transplanting of larger plants was a technique that was successfully implemented to achieve a desired design effect on many projects.

Culyer's tree moving machine.

Frederick Law Olmsted, Sr. had large trees successfully transplanted on some of his most important design projects. During the 1850's while working on New York's Central Park in collaboration with Calvert Vaux, F.L. Olmsted Sr. endorsed the use of "extra sized trees" to establish the look and feel of a mature landscape. In their "Greensward Plan" for the park, F.L. Olmsted specified large American elms along the park's promenade. In his opinion, this species had "the vigor and vitality of a young tree until it has grown to be of large size, and will, therefore, bear to be successfully transplanted for immediate effect."[1] In the early 1870's, at Brooklyn's Prospect Park, F.L. Olmsted once again relied on the planting of mature trees. Olmsted and Vaux intended to "augment the existing landscape" with the planting of large trees and with groves and shrubbery.[2] To facilitate this vision, F.L. Olmsted directed workers to transplant many existing large trees and shrubs from within the property. Much of this work was performed with the aid of a tree moving machine invented specifically for the job by the park's assistant engineer John Culyer. With the use of Culyer's invention, crews transplanted 284 trees during 1872, most of them mature specimens.

Despite proven successes, there were problems associated with large tree moving. Generally, the Olmsted Brothers and other members of the firm refrained from recommending this practice to


Mature trees ready for transporting by barge, c. 1900.

Field team after preparing a mature tree for transplanting, c. 1920.

Moving a mature bare root tree. Isaac Hicks and Son Nursery, c. 1860.

clients in later years. The procedure was inherently expensive, required significant planning and site preparation, a highly skilled field team, caused major site disturbance and often resulted in high tree mortality with most survivors achieving only stunted growth in subsequent years. In several writings, John Charles Olmsted indicated that "the consensus of opinion of all experts is to the effect that it is preferable to plant trees of nursery sizes," and landscape architects should discourage clients from planting large trees whenever possible to minimize adverse impacts to the landscape and "avoid the waste of money and lack of success."[3]

However, despite his misgivings, the Olmsted firm did continue, on occasion, to plant large trees. John Charles Olmsted conceded it could be considered "good policy" in special cases where an immediate impact was desired, including his father's previous use of the American elms on the Central Park promenade, a case he believed where "the result justifies the disregarding of the general rule."[4]

Perhaps the most important factor in ensuring the continued use of this technique by the firm was John Olmsted's deference to a well-informed client. He believed in a professional setting, whatever the landscape architect's personal views, the client's wishes and resources were often the deciding factor in determining how a job was to be implemented. If clients "were willing to pay what it costs to move trees in the best possible manner," which included the use of skilled workers supervised by an experienced landscape architect, then Olmsted conceded "there is no sufficient reason why they should not have what they are willing to pay for."[5]

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[1] Charles E. Beveridge and David Schuyler, editors, *The Papers of Frederick Law Olmsted: Volume III Creating Central Park, 1857-1861* (Baltimore, Maryland: The Johns Hopkins University Press, 1983), p. 154.

[2] Richard J. Berenson and Neil deMause, *The Complete Illustrated Guidebook to Prospect Park and the Brooklyn Botanic Garden* (New York: Silver Lining Books, 2001) p. 27.

[3] James L. Greenleaf, *Large Tree Planting, March 4, 1905, from Transactions of the American Society of Landscape Architects, 1899-1908* (Source: ASLA, Washington, DC).

[4] *Moving Large Trees, 1861.* Courtesy of the National Park Service, Frederick Law Olmsted National Historic Site (Olmsted NAB NAC Collection, NAB 1861).

[5] Ibid.

RECORD KEEPING

Recording information about the removal and replacement of trees in cultural landscapes can provide valuable documentation for future reference. As years pass and personnel changes, records of previously accomplished work can inform current preservation and management decisions.

Detailed information related to work performed, changes in condition and sources of materials should be recorded. A record keeping form, such as the one illustrated, can be used to document information. If time for recording information is limited, at a minimum, receipts, field notes and other documentation related to tree removal and planting should be retained until such time that it can be transferred to a more permanent format.

Information that should be collected and recorded includes:

- Date the work was performed and weather conditions
- Location of planting including a map and photographs
- Information regarding the protection of adjacent resources
- Size of the tree removed and/or replanted
- Method used to remove the stump and replant the tree
- Source of replacement materials including the tree, backfill soil, mulch, etc.
- Recommendations or observations from cultural resource specialists such as archeologists, landscape architects, etc.
- Additional information that future landscape staff would find useful to understand the history and scope of work accomplished

Statue of Liberty National Monument

RECORD KEEPING - FEATURE: LONDON PLANE TREE

Record notes on measurements, conditions, work performed, reason for removal, replacement or installation, propagation method and growing location, status of feature, or reference to a related report, etc.	Measurement	Condition/ Problem	Major Work/ Change	Removal	Replacement	Installation	Propagation	Other	Date and Initials Also note references for any additional information
All deadwood and watersprouts removed by Arboriculture class from University of Massachusetts.			X						AF 8/92
Replaced tree #4-0-26 with London Plane Tree, anthracnose-resistant cultivar 'Columbia'. Installed through Gardener Intake Project.					X				AF 4/93
#4-0-26 damaged by vandalism, re-set and restaked.		X							AF 5/93
Removed and replaced #4-0-37 with London Plane Tree, anthracnose resistant cultivar 'Liberty' in order to compare with 'Columbia'.					X				AF 5/93
#4-0-26 'Columbia' and #4-0-37 'Liberty' both in fairly good condition. Both received water by gator bag 1x a week during July and August.		X							XAF 8/93

Sample record keeping form documenting field work accomplished.

OLMSTED CENTER *for* LANDSCAPE PRESERVATION

RECORD KEEPING - FEATURE: _____

Record notes on measurements, conditions, work performed, reason for removal, replacement or installation, propagation method and growing location, status of feature, or reference to a related report, etc.	Measurement	Condition/ Problem	Major Work/ Change	Removal	Replacement	Installation	Propagation	Other	Date and Initials

from the archives

Photo captions:

1. Isaac Hicks and Son Nursery transporting a large tree for planting, c. 1860.
2. Tree planting crew, Lincoln Memorial, Washington, D.C., c. 1915.
3. Preparing a large tree for transplanting, c. 1860.
4. Removing a tree in preparation for transplanting, c. 1870.
5. Preparing to plant a large tree at Lincoln Memorial, Washington, D.C., c. 1915.

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http://www.nps.gov

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http://www.nps.gov/oclp

National Association for Olmsted Parks
http://www.olmsted.org/

Historic Landscape Initiative
Heritage Preservation Services
National Park Service
United States Department of the Interior
http://www.cr.nps.gov/hps/hli/

The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes
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United States Department of the Interior
http://www.cr.nps.gov/history/online_books/hps/contents.htm

Links to the Past
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Credits:

Courtesy of the *National Park Service, Frederick Law Olmsted National Historic Site*:
Historic photographs on pages 1 (masthead, left and right), 5, 8, 9, and 12.

Courtesy of the *National Park Service, Olmsted Center for Landscape Preservation*:
Photographs on page 1 (masthead, middle, and background), 2, 3, and 4.
Line drawings on pages 6 and 7.
Forms on pages 10 and 11.

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OLMSTED CENTER
for LANDSCAPE PRESERVATION

The Olmsted Center for Landscape Preservation, a program of the Northeast Region, National Park Service, promotes the stewardship of cultural landscapes through research, planning, sustainable preservation maintenance and education. The center perpetuates the tradition of the Olmsted Landscape Architecture Firm and Frederick Law Olmsted Sr.'s lifelong commitment to people, parks and public spaces.

The National Association for Olmsted Parks (NAOP) advances Olmsted principles and the legacy of irreplaceable parks and landscapes that revitalize communities and enrich people's lives. Established in 1980, NAOP is a coalition of design and preservation professionals, historic property and park managers, scholars, municipal officials, citizen activists and representatives of numerous Olmsted organizations around the United States.