Treatment of Plant Features

Introduction

Virtually all cultural landscapes are influenced by and depend on natural resources and processes. In many ways, the dynamic qualities inherent in natural systems differentiate cultural landscapes from other cultural resources. Plant and animal communities associated with human settlement and use are considered "biotic cultural resources." These can reflect social, functional, economic, ornamental, or traditional uses of the land.

Vegetation is considered a biotic cultural resource when it can be linked to an established period of significance and adds to the overall significance of the landscape. Vegetation is a common landscape characteristic associated with the historical development of a cultural landscape or resulting from cultural activities on the land. Vegetation has a cycle of growth, change, and eventual death and often requires constant management and intervention to retain its overall structure and appearance. The features associated with vegetation are recognized as either a system (such as a forest or wetland), an aggregation of plants (such as a hedge or orchard), or an individual plant (such as a tree or shrub), all of which have distinct, unique, or noteworthy characteristics in a landscape.

It is important to understand the degree to which change contributes to or compromises the historic character of a cultural landscape, and the way in which natural cycles influence the ecological processes within a landscape. For example, preservation of a single tree in a designed landscape may be critical to the overall integrity of the design. In contrast, an entire woodlot may have significance, in which case it is necessary to preserve the ecological processes of the system rather than an individual tree. Determining a treatment strategy for the vegetation within a cultural landscape involves consultation with appropriate natural resource professionals.

Figure 1. Planted in the early nineteenth century, this Ginko Tree is an individual plant feature. Vanderbilt Mansion National Historic Site. (NPS, 1995)

This text describes the process of historical research, existing conditions investigation, and analysis and evaluation conducted during the preparation of a Cultural Landscape Report (CLR) as it relates to treating vegetation, in particular individual plants and aggregations of plants. Individual plants are solitary (see Figure 1), whereas an aggregation of plants is a physical grouping of multiple individuals of the same plant type, such as a hedge, allee, bosk, and orchard. The aggregation of plants shares the same aesthetic or functional role in the landscape because of the collective arrangement of plants in space. In most cases, an aggregation of plants can be treated similarly to an individual plant because its composition is uniform. (See Figures 2 and 3.)

This text emphasizes the need to determine, during analysis and evaluation, how the features of vegetation contribute to the significance of a landscape. This is particularly important in selecting a primary treatment for a landscape and in implementing treatment and management of plants. This text also discusses special considerations for treatment activities, including replacement of declining vegetation. Because vegetation is living material, plant replacement is an inevitable activity regardless of the treatment. Throughout this text, the term "plant features" refers to both individual plants and aggregations of plants that contribute to the significance of a cultural landscape and retain integrity.

Biotic Cultural Resource Management

The treatment and management of biotic cultural resources was first discussed in Ian Firth's 1985 study: *Biotic Cultural Resources: Management Considerations for Historic Districts in the National Park System, Southeast Region*. The treatment and management of agricultural landscapes, battlefields, and private estates in the Southeast are described using the extant plants and animals associated with historic uses of the land. The document emphasizes the need to preserve biotic cultural resources as a historic record and a living connection with the past, as well as abiotic features that convey the historic character and significance of a landscape.

In a discussion of the treatment of biotic cultural resources in accordance with the Secretary of the Interior's Standards, the 1985 study illustrates the unique challenges in preserving biotic, rather than abiotic features. Biotic features have an inherently dynamic nature, that gives rise to such challenges as managing the size of livestock herds, the need to sow and harvest agricultural crops, resisting ecological succession in a now unglazed pasture, and interpreting the role of a replanted seedling forest in the maneuvers of a Civil War battle, despite the slow pace of restoration. Referring to the attempt to restore biotic cultural resources to depict the appearance of a historic period, Ian Firth states:

> *A repetition of a historic scene composed of several plant and animal communities requires a conjunction of all biotic cycles in their appropriate phases. Therefore, like Halley's Comet, a historic scene may return perhaps once in a lifetime.*

The treatment and management of biotic cultural resources must anticipate and plan for the natural process of change. It must establish acceptable parameters for change and manage the appearance of biotic resources within those parameters.

Figure 2. These evergreen shrub hedges represent an aggregation of plants. Eugene O'Neill National Historic Site. (NPS, 1944)

Figure 3. This birch allee is an aggregation of plants. Saint-Gaudens National Historic Site. (NPS, 1966)

Plant Features and the CLR

Historical Research

Historical research is performed while preparing a CLR to produce the site history narrative. The narrative describes and illustrates the development and appearance of a landscape through successive historic periods. When vegetation is a characteristic associated with the historic development of a landscape, research includes identifying the historic location, appearance, and identity of plant features during each relevant period. (See Figures 4 and 5.)

Sources for historic research of plants include: historic maintenance logs, agricultural records, personal letters, diaries and journals, receipts of plant purchases, historic photographs (including historic aerial photographs), paintings, sketches, planting plans, and oral histories. (See Figure 6.)

Figure 4. The historic record for Rim Village indicated that large trees were selected from other areas in the park, root pruned, and transplanted to the Rim as part of the designed landscape. Crater Lake National Park. (NPS, 1933)

The identification of plants from historic documentation sources, rather than from living or herbarium specimens, is a special technique that may require a plant taxonomist. Some site investigation techniques, such as archeobotanical analysis (the analysis of pollen, phytoliths, and macroflora) and tree coring can also yield information on the existence of plants in historic periods.

Existing Conditions Investigation

The existing conditions investigation provides an understanding of the present conditions of a cultural landscape. The investigation involves both a site survey and site research to identify and document the location and condition of all extant landscape characteristics and associated features, including vegetation and plant features. (See Figure 7.) Based on the site survey and research,

Figure 5. Research illustrated that large conifers were moved and planted at Rim Village in the 1930s to create a "natural appearing landscape." Crater Lake National Park. (NPS, 1933)

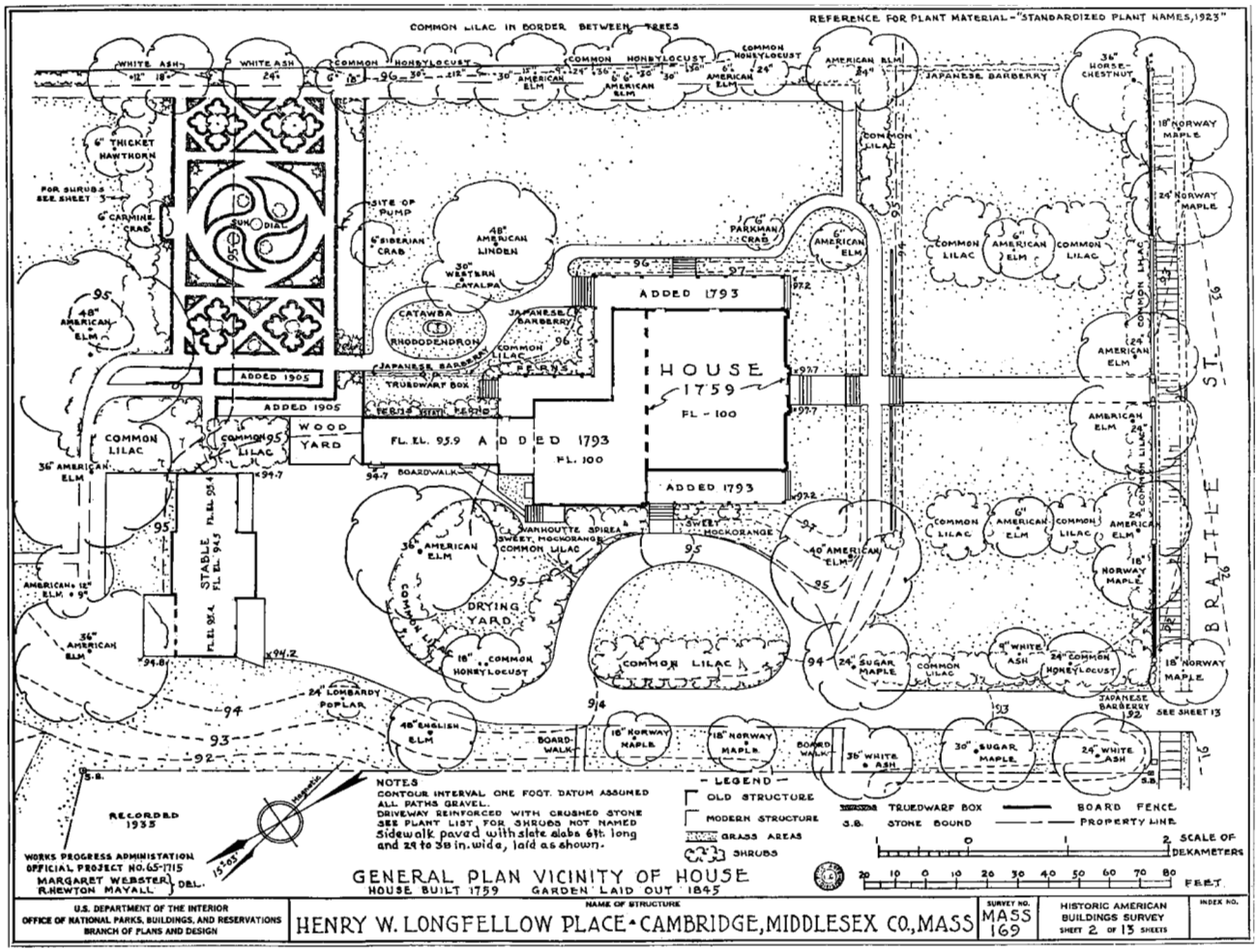


Figure 6. A Historic American Building Survey (HABS) plan of Longfellow Place. The early HABS survey of the landscape identifies plant names and is a valuable source for historic plant information. Longfellow National Historic Site. (NPS, 1935)

plant features may be graphically documented with line drawings (sketches, measured sections, and plans), black and white photographs, color slides, and videography. (See Figure 8.)

Information on the identity and condition of existing plants also may be gathered during a plant inventory. A plant inventory is a specialized type of site survey that focuses exclusively on existing plants. A plant inventory identifies and locates all existing plants, regardless of whether they are known to be associated with a landscape's period of significance.

Information about contemporary introductions of plants, or plant recolonizations, is particularly important in treating and managing plants. If plants cannot be accurately identified in the field (the plant is an unknown variety or cultivar), it may be necessary to make a herbarium specimen with a representative sample from the plant. A botanist or horticulturist can later identify the representative sample. Site investigation techniques used to identify and map existing plant features may include aerial photograph analysis, aerial photogrammetric surveys, topographic surveys (which locate vegetation masses and individual plants),

Figure 7. Field documentation of plants at Lake Crescent Lodge. Olympic National Park. (NPS, 1984)

Global Positioning System with a Geographic Information System, and hydrographic surveys for submerged vegetation.

Analysis and Evaluation

The analysis and evaluation performed while preparing a CLR compares the findings of the site history with the existing conditions investigation to determine the type and extent of landscape change since a site's earliest historic period. The analysis and evaluation identifies the extant landscape characteristics and associated features and defines their contribution to a landscape's significance. If vegetation is a landscape characteristic, plant features are analyzed to determine their integrity and association with the landscape's significance.

In analyzing and evaluating vegetation and plant features, the process must acknowledge the dynamic nature of living organisms; plant features will have changed in appearance since the historic period(s). Therefore, evaluating the integrity of plant features involves determining whether a plant's contemporary appearance is evidence of an association with the significance of a landscape. Plant features may retain integrity if the historic type, distribution, size, and structure are still recognizable.

Plant features are evaluated according to National Register criteria in the same manner as abiotic features of the landscape. Plant features may be associated with a significant event, person, design, or function, or have the potential to yield information about the history or prehistory of a landscape. But generally, plant features are not significant independent of their landscape context; rather, they contribute to the significance of the entire cultural landscape. For example, the fruit trees of Adams National Historic Site in Massachusetts are associated with the lives of John and Abigail Adams (criterion A). The woods and fields of Chickamauga-Chattanooga National Military Park in Georgia are associated with the event of a Civil War battle. The woods influenced the pattern of maneuvers and conduct of the battle in the landscape in 1863 (criterion B). The indigenous eastern woodland of Prospect Park, Brooklyn, New York is associated with the picturesque design of the landscape. The design was carved from the existing woods by Olmsted and Vaux in 1868 (criterion C). The filbert trees of the 75-acre, 90-year-old orchard of Dorris Ranch in Oregon have yielded information about the early cultivation and breeding of filberts in the

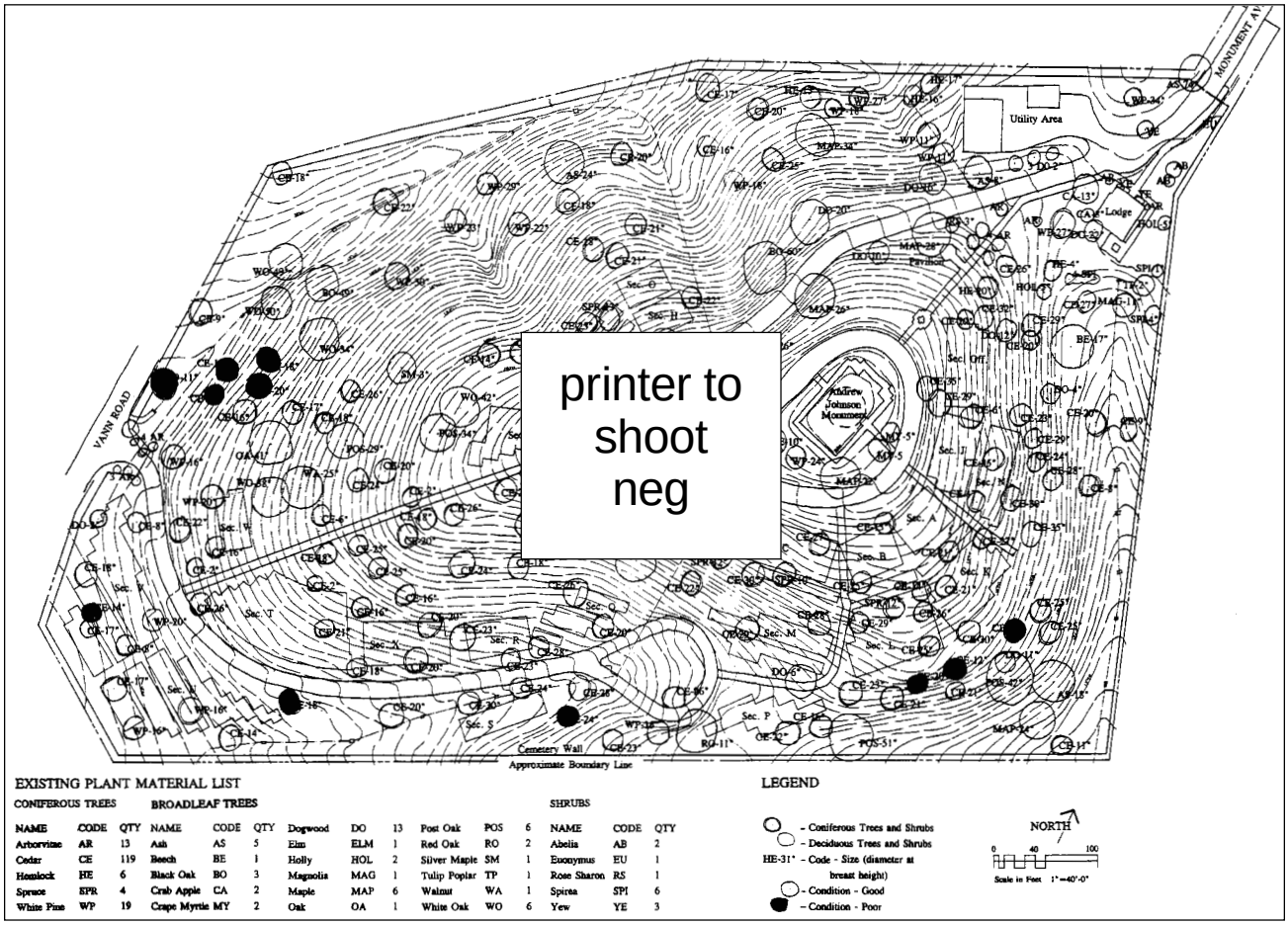


Figure 8. This vegetation assessment plan identifies broadleaf and coniferous trees, and indicates their common name, quantity, diameter at breast height, and physical condition. Andrew Johnson National Cemetery. (NPS, 1992)

United States in their experimental planting arrangements, spacing, culture, and genetic composition (criterion D).

An understanding of the significance of plant features in a landscape is a critical factor in determining how it should be managed. For example, the fruit trees at the Adams National Historic Site were one of the reasons John and Abigail purchased the property south of Boston in 1787, and subsequent generations of the Adams family continued to plant and experiment with the fruit trees. The orchard is an important feature in light of its association with the Adams family. The type and variety of plant material may also contribute to the significance of a cultural landscape. An inventory of the orchards at the Moses Cone Estate on the Blue Ridge Parkway uncovered several unusual varieties of apples that date from the turn of the century. These historic cultivars are part of the historic record at this site, and because of their rarity these cultivars should be genetically preserved within the landscape (through maintenance and propagation for genetic authenticity).

The importance of the plant material may also be derived from its function in the landscape as part of a particular design or land use practice rather than

from its association or unique genetic makeup. At Eleanor Roosevelt's rural retreat, Val-Kill (now Eleanor Roosevelt National Historic Site), in Hyde Park, New York, a line of red pines was an effective screen between the drive and the stone cottage during the 1950s. As the pines matured, the lower limbs were lost with a resulting loss of screening. To regain the function of the pine hedge as a landscape feature, the trees were removed and replaced in-kind. A decision was made that the significance of the red pines as a hedge in the landscape was more important than the fact that they were original plantings from the time when Mrs. Roosevelt lived on the property. Similarly, in vernacular landscapes, such as an agricultural district, perpetuation of a particular crop may not be as important as the retention of the overall landscape patterns.

Treatment

The treatment section in a CLR either states the primary treatment (if already known through park planning), proposes a primary treatment (preservation, rehabilitation, restoration, or reconstruction), or proposes treatment alternatives for a cultural landscape. Landscape character areas and management zones may also be discussed in the treatment section of a CLR.

Determining the primary treatment (the goal for the overall appearance of the landscape) for a cultural landscape is influenced by the following:

- integrity and condition of the biotic and abiotic features
- management objectives for the park
- type of cultural landscape and significance
- contemporary use of the landscape

Treatment is guided by policy, guidelines, and standards contained within *NPS Management Policies, Cultural Resource Management Guideline*, and *The Secretary of the Interior Standards for Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. These documents identify four treatments for cultural landscapes: preservation, rehabilitation, restoration, and reconstruction.

Plant features are addressed in relation to the primary treatment for a cultural landscape, along with designated character areas or management zones. For example, the CLR for the Van Buren National Historic Site in New York proposes restoration as the primary treatment, and treatment recommendations include replanting the fruit orchards that existed during Van Buren's occupation. The CLR for the Frederick Law Olmsted Site in Brookline, Massachusetts proposes restoration of the landscape to its appearance circa1930 to illustrate the landscape designed and developed by Frederick Law Olmsted, Sr. and perpetuated by his sons, John Charles and Frederick Law Olmsted, Jr. As a result, the CLR prescribes removing over 200 nonhistoric trees and shrubs and introducing over 800 trees, shrubs, and vines based on the character of the landscape in circa1930. (See Figure 9.)

All treatments for a cultural landscape are represented by a sequence of activities given in order of increasing physical intervention: protect and maintain, repair, replace, design for missing features, and design compatible alterations and

Figure 9. Photographs showing before and after the clearing of recolonizing vegetation. This activity was part of a restoration treatment plan. Frederick Law Olmsted National Historic Site. (NPS, 1994)

additions. The sequence first establishes that significant features, such as plant features, are preserved by regular maintenance and by protecting them from adverse influences. The sequence promotes repairing before replacing deteriorated features, requires substantiated design for replacing missing features, and asserts that alterations and additions be compatible with the historic character of the landscape. The frequency with which various activities occur varies with a given treatment. For example, the majority of activities in preservation involve protection, maintenance, and repair, while restoration involves more replacement and design for missing features.

Special Considerations for Treatment Activities

Treatment activities applied to plant features may be restricted, modified, or influenced by:

- protection and maintenance
- repairs and replacement

Protection and Maintenance

The protection and maintenance of significant plant features, including their form and scale in a landscape, is a high priority in all treatments. Good horticultural practices can enhance the longevity of significant plant material. Although genetics is a major factor in determining plant longevity, external factors can also play a role. For example, erecting barriers, staking, tying, and cabling plants are protective measures that can be performed. Maintenance is performed by irrigating, fertilizing, pruning, dividing, transplanting, mowing, and performing integrated pest management. Such activities create a favorable growing environment and promote the health of plants, but they may also be designed to achieve particular visual effects.

With an aggregation of plants, each individual plant is equally protected and maintained to achieve a uniform effect. The protection and maintenance of plants must integrate a knowledge of the cultivation requirements of individual plant species with an understanding of the primary landscape. For example, the optimal growth and reproductive potential of a plant may be compromised to achieve a visual appearance that accurately conveys the landscape's significance. Protection and maintenance regimes may be modified to achieve a particular effect (for instance, infrequent or high grass mowing to resemble the appearance of meadow-like sod that existed before the advent of lawnmowers).

Contemporary environmental legislation may restrict the protection and maintenance of plants associated with the significance of a cultural landscape. Many old cultivars or varieties of agricultural crops are prohibited by federal or state law to prevent new epidemics of pests and diseases and conserve soil fertility. For example, each year at the Shiloh National Military Park in Tennessee, a representative portion of land is planted in cotton to reflect the appearance of the land at the time of the Civil War battle. To guard against loss of soil fertility, state law requires that the cotton crop be rotated to a different area each year.

Contemporary standards of environmental quality also affect land management practices. These standards may influence the protection and maintenance of certain plant species or affect current practices that eradicate others. New technologies, such as geotextiles and biological pest controls, should be integrated wherever possible into the protection and maintenance of plant features.

Repair and Replacement

The repair of plant features may involve remedial or rejuvenative pruning, cabling, or grafting to remove infection or decay, provide physical support, and promote healing or the regeneration of new tissue. Plant features must be closely monitored to determine the vitality of plants and identify agents that may cause their decline. Replacement typically occurs when repair is no longer possible. Loss of vitality due to age, pest and disease infestation, mechanical damage, natural disasters, or environmental modification may negate attempts at repair and necessitate replacement.

Replacing plant features involves removing a declining plant in a particular location and replanting it with another plant. (See Figures 10 and 11.) The replacement plant may be genetically identical to the former plant, taxonomically the same, or be a substitute cultivar, variety, species, or genus for the former plant. The desired degree of authenticity of the replacement plant is a decision influenced by various factors, but it is primarily based on the association of the plant with the landscape's significance.

When repair and replacement is applied to an aggregation of plants, it may involve just one individual of the group (removing and replanting one dying individual) or the entire group (removing and replanting every plant). The decision to remove and replant one or all individuals of an aggregation of plants must consider two factors:

- whether the feature still conveys its association with the significance of the landscape in its current state
- the vitality, longevity, growth rate, and size of the plant to be replanted

The questions to be answered are what is the condition and anticipated life span of the remaining plants of the feature, and what will be the visual effect of incremental replacement in terms of conveying the historic character of the landscape?

For example, at Saint-Gaudens National Historic Site in Cornish, New Hampshire, the home and studio of the nineteenth century sculptor, Augustus Saint-Gaudens, a significant aggregation of plants is the more than one mile of hedges that divide the landscape into intimate garden rooms. Historically, the hedge was primarily white pine transplanted from the surrounding fields. Park maintenance staff has developed a replacement strategy that integrates new material into the existing hedge. In contrast, if the individual elements of the hedge were deteriorated, missing, or out of scale with the original intent, so that the historic feature as a whole was no longer discernible, the entire hedge would be replaced.

Figure 10. Boxwood around these ponds did not thrive in the climatic conditions and was therefore replaced with Japanese Holly. Naumkeag in Stockbridge, Massachusetts. (Photograph courtesy of the Trustees of Reservations, n.d.)

Figure 11. Japanese Holly being planted as a functional replacement for Boxwood. Naumkeag in Stockbridge, Massachusetts. (Photograph courtesy of the Trustees of Reservations, n.d.)

In-Kind Replacement

The in-kind replacement of plant features in a cultural landscape involves replanting with the same cultivar, variety, or species as the former plant. The degree of authenticity selected for the replacement plant should consider the particular association of the former plant with the significance of the landscape and the primary treatment for the landscape. Individual plants and aggregations of plants directly associated with the significance of a landscape may require the highest level of genetic authenticity in their replacement.

For example, at Adams National Historic Site, the genetic identity of the fruit trees (their particular varieties) is of great importance in associating them with the landscape's significance (the acquisition and development of the property by John and Abigail Adams). The fruit tree replacement at the Adams' property therefore requires the highest level of authenticity. Replacing one dying tree in a woodland of a designed landscape would not require the highest level of genetic authenticity because each tree is indirectly associated with the significance of the landscape. In this case the exact genetic replacement of the dying tree is not as important as the protection, cyclical maintenance, repair, and replacement of the entire woodland. A dying tree may be felled and left as a nurse log, allowing natural regeneration to take place. A replacement tree could be the same species as the former tree or another species of the woodland, according to the management regimes established for the entire woodland. Woodland managers may insist that the replacement tree has the same provenance as the former tree (originating from seed of the same localized region in the United States), but woodland managers would generally discourage attempts to clone the former tree, as genetic diversity contributes to the vitality of such plant communities as woodlands.

The need to clone a plant in decline may be due to the lack of availability of a replacement plant through other sources. Some plants of cultural landscapes are no longer commercially available, either because they are no longer fashionable (extinct as a result of lack of propagation), or they are difficult to find as "unimproved" (nonhybridized) straight species or varieties. Some plants can be found in other cultural landscapes where they have been accurately identified and maintained. But when a source cannot be found for a plant in decline, vegetative propagation guarantees the accurate identity of the replacement plant and the prevention of extinction of the cultivar, variety, or species. If old-fashioned cultivars, straight varieties of exotic plants, or other unusual forms of plants exist, it is useful to check on plant availability before the onset of mortality so that a viable propagule can be made. When genetic authenticity is important, the spectrum for the genetic authenticity of replacements should be considered when planning a replacement.

Plants can be asexually propagated by cuttings, by grafting onto another plant, or sexually propagated by seed, with genetic authenticity decreasing, respectively. Nursery stock has no direct genetic association with the original plant to be replaced; the greatest level of authenticity of nursery stock is another individual of the same variety or species. Note: cultivars must be asexually propagated. All members of a cultivar (or a man-made cultivated variety) are genetically identical.

Substitutions

In-kind replacement of the original species or variety may not be possible because of changes in the site's growing conditions, disease and insect problems, or simply because the original is no longer available. In these cases, substitution of plant material may be necessary. This may be the appropriate action when plants negatively impact the habitat of a rare and endangered species or a diseased plant cannot be replaced

Genetic Authenticity of Plant Replacements

The following list, prepared by the Olmsted Center for Landscape Preservation, illustrates the spectrum of genetic authenticity associated with the following types of plant propagation.

Highest Level of Genetic Authenticity

CLONAL

- Shoot Cuttings
- Root Cuttings

Intermediate Level of Genetic Authenticity

SUBCLONAL GRAFTING

- Cloned Rootstock x Cloned Scion
- Cloned Rootstock or Scion x Seedling Rootstock or Scion
- Seedling Rootstock x Seedling Scion

SEEDLINGS

- Manually Pollinated, Seed Collected from Original Plant
- Naturally Pollinated, Seed Collected from Original Plant
- Naturally Pollinated, Seed Collected from Same Plant on Site

Lowest Level of Genetic Authenticity

NONCLONAL NURSERY STOCK

- Substitution of Cultivar or Variety
- Substitution of Species
- Substitution of Genus

with the same plant. For example, Anthracnose disease precludes the replanting of the dogwoods Cornus florida or Cornus nuttalli with these species, and Dutch Elm disease precludes the replanting of American Elm, Ulmus americana with the same species, though the Liberty Bell or Princeton cultivars are disease-resistant substitutes.

In decisions on substitution, care should be given to match the visual, functional, and horticultural characteristics of the historic plant material. A substitute plant should be compatible with the role of the former plant in its association with the significance of the landscape. The importance of the former plant's genetic identity, aesthetic or functional historic role, physical form, texture, color, size, and longevity should be considered in selecting the substitute plant. These attributes may include the form, shape, and texture of the original, as well as its seasonal varieties, such as the bloom time and color, fruit, and fall foliage. When substitutions are made, it should be recorded to allow future generations to distinguish between historic plants and later alterations and additions to the landscape.

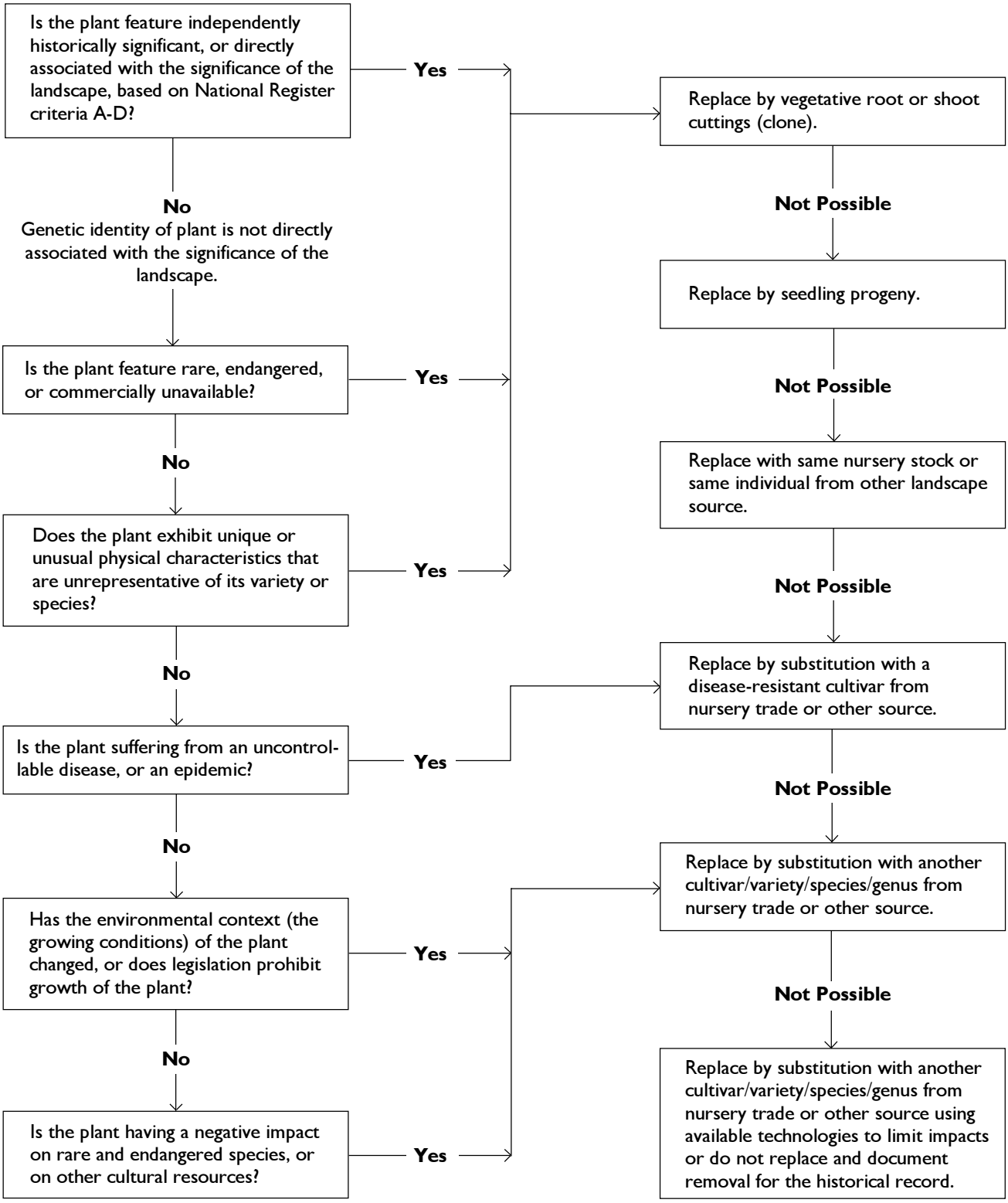
Ideally, plant features should be protected, maintained, repaired, and replaced (in-kind or with substitutions) to accurately preserve the historic character of a cultural landscape. However, under some circumstances, plants that are removed are not replaced. For example, if a plant feature threatens the perpetuation of an endangered species, it may not be preserved or replaced. In addition, when the growth of a plant feature is undermining the structural integrity of another cultural resource, such as the facade of a building or a buried archeological resource, the plant may be removed before its decline and not replaced. However, prior to the removal of such plant features, the available technologies, such as root barriers and support systems in replanting attempts, as well as the plant's association with the significance of the landscape should be considered.

Management Considerations

Beyond the implementation of a treatment plan, all treatment activities eventually focus on protection, maintenance, repair, and replacement. Preserving the landscape characteristics and associated features is the focus of landscape management. The changing appearance of the landscape must be anticipated through planning and managed within well defined parameters that best support the significance of the landscape.

When protection and maintenance are regularly practiced, the requirement for repair is infrequent and the cyclical need for replacement can be anticipated. Maintaining accurate plant records is useful for management. These records may include information on the anticipated longevity of a plant feature, current condition, protection and maintenance regimes, and records of repair and replacement interventions. A record of the anticipated replacement strategy can be included for each plant feature to expedite the replacement process when replacement is necessary. A replacement strategy is particularly important for plant features that will be propagated, because

Decision Process for Replacement of Plant Features



cuttings or grafts must be taken from live, healthy tissue, and special growing facilities may need to be used. Herbarium specimens of plant features, particularly those to be replaced, are excellent archival records.

REFERENCES

General

Birnbaum, Charles A. September 1994. *Preservation Brief No. 36: Protecting Cultural Landscapes: Planning, Treatment, and Management of Historic Landscapes*. Washington, DC: USDI, NPS, Preservation Assistance Division.

Birnbaum, Charles A., with Christine Capella Peters, eds. 1996. *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. Washington, DC: USDI, NPS, Heritage Preservation Services.

Bratton, Susan, ed. 1988. Vegetation Change and Historic Landscape Management. In *Proceedings of the Conference on Science in the National Parks, Colorado State University*, 1986. Washington, DC: The George Wright Society and the NPS.

Clark, James R. August 1993. Age Related Change in Trees. *Journal of Aboriculture* 9 (8): 201-205.

Clark, James R., and Nelda Matheny. July 1991. Management of Mature Trees. *Journal of Aboriculture* 17 (7): 173-183.

Cobham, Ralph, ed. 1990. *Amenity Landscape Management: A Resource Handbook*. New York: Van Nostrand.

Coffin, Margaret. 1995. Cultural Landscape Publication No. 7: *Guide to Developing a Preservation Maintenance Plan for a Historic Landscape*. Brookline, Massachusetts: USDI, NPS, Olmsted Center for Landscape Preservation.

Couch, Sarah, H. 1991. Trees in Line for Conservation. *Landscape Design* 214: 24-30.

_____. 1992. The Practice of Avenue Planting in the Seventeenth and Eighteenth Centuries. *Garden History* 20 (2): 173-200.

Firth, Ian. 1985. *Biotic Cultural Resources: Management Considerations for Historic Districts in the National Park System, Southeast Region*. Georgia: USDI, NPS, Southeast Regional Office.

Loeb, Robert, E. 1993. Long Term Arboreal Change in a Landscaped Urban Park: Central Park, New York. *Journal of Aboriculture* 19 (4): 238-249.

McGann, Martin, R. 1989. Maintaining the Historic Garden. *The Public Garden* 4 (3): 22-25, 38.

Meier, Lauren. April 1992. The Treatment of Historic Plant Material. *The Public Garden*.

Meier, Lauren, and Nora Mitchell. 1990. Principles for Preserving Historic Plant Material. *Preservation Technology Update* 6. Washington, DC: USDI, NPS, Preservation Assistance Division.

Mitchell, Nora J., and Robert R. Page. 1993. Managing the Past for the Future. *Historic Preservation Forum* 7 (3). Washington, DC: National Trust for Historic Preservation.

National Park Service. July 1997. *Cultural Resource Management Guideline*, no. 5. Washington, DC: USDI, NPS, History Division.

Remple, Sharon. 1992. Conserving and Managing Living Plant Collections. *APT Bulletin* 24 (3 and 4): 69-70.

Treib, Marc. Spring 1994. The Care and Feeding of Noble Allee. *Arnoldia* 54 (1): 12-23.

Van Valkenburgh, Michael, and Peter Del Tredici. Spring 1994. Restoring the Harvard Yard Landscape. *Arnoldia* 54 (1): 2-11.

Weinstein, Geraldine. 1985. Replacing the Understory Plantings of Central Park. *Arnoldia*, 45 (2): 19-27.

Wright, Tom. 1982. The Maintenance and Management of Historic Gardens. *Large Gardens and Parks: Maintenance Management and Design*, 135-144. London: Granada.

Plant Propagation References

Clark, G., and Alan Toogood. 1992. *The Complete Book of Plant Propagation*. London: Ward Lock.

Dirr, Michael, and C.W. Heuser, Jr. 1987. *The Reference Manual for Woody Plant Propagation*. Athens, Georgia: Varsity Press.

Hartman, Hudson T., et al. 1990. *Propagation: Principles and Practices*. 5th ed. Englewood Cliffs, New Jersey: Prentice Hall.

Herbarium Specimens References

Arnold Arboretum. 1968. Notes on Making an Herbarium. *Arnoldia* 28 (8-9): 69-92.

Bridson and Leonard Foreman. 1992. *The Herbarium Handbook*. Kew, England: Royal Botanic Gardens.

Robertson, Kenneth, R. 1980. Observing, Photographing and Collecting Plants. *Illinois Natural History Survey Circular* 55.

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes.

U.S. Department of the Interior
National Park Service
Cultural Resources

Park Historic Structures & Cultural Landscapes