

North Carolina Department of Cultural Resources

Landscape Management Plan

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Adopted June 1, 2006

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Introduction

The intent of the Landscape Management Plan, herein referred to as the plan and adopted in June of 2006, is to establish a sound environmentally conscientious roadmap for all landscape projects within the North Carolina Department of Cultural Resources (DCR). The plan is but one component of DCR's contribution to N.C. Project Green, which is a state initiative meant to embrace sustainable planning practices for all state agencies. The purpose of the plan was identified in the long-term goals of DCR's Environmental Sustainability Plan as adopted in 2001. The plan is applicable to the maintenance of properties within DCR.

The Landscape Management Plan is in the format of an "electronic notebook" that can easily be modified as new information from other sources and organizations is made public and as new technology is made available. Thus, up-to-date material can be "clipped" into the notebook, and the plan can remain current instead of becoming out-of-date shortly after being adopted. Users of the plan are encouraged to send comments and recommendations about the plan to Jeff Adolphsen, RLA, Restoration Specialist, Restoration Branch, HPO, 4617 Mail Service Center, Raleigh, NC 27699-4617 or jeff.adolphsen@ncmail.net.

General landscape maintenance issues, such as lawn cutting and irrigation, will be broadly discussed within the text of the plan. These landscape maintenance issues will be discussed in greater depth by listing specific examples within DCR where a specific action was undertaken. Lastly, each landscape maintenance issue will include a list of sources for additional information if the reader requires more specific information.

Users of the plan should be advised that certain undertakings might require consultation with the North Carolina State Historic Preservation Office (HPO). Consultation with the HPO is required, according to Section 106 of the National Historic Preservation Act of 1966, *General Statutes of North Carolina*, c. 121, s. 12(a), and Executive Order XVI (promulgated on May 3, 1976, by Governor James E. Holshouser), when a project has an effect on a property that is listed in or may be eligible for listing in the National Register of Historic Places and when that project uses or requires federal or state funding, license, permit, or approval.

The North Carolina Department of Cultural Resources would sincerely like to thank those professionals who reviewed this plan. Those reviewers include Bill Alexander, landscape and forest historian at Biltmore Estate in Asheville, North Carolina; Charles Birnbaum, coordinator of the Historic Landscape Initiative with the National Park Service in Washington D.C.; Matt Noyes, director of horticulture for Old Salem in Winston-Salem, North Carolina; Kim Powell, professor emeritus of horticulture at North Carolina State University in Raleigh, North Carolina; Marty Wiggins, community development program director for the North Carolina Department of Environment and Natural Resources in Raleigh, North Carolina; and Lisa Wimpfheimer, horticulturist and head of garden services at Tryon Palace Historic Sites & Gardens, New Bern, North Carolina.

Overview

The plan applies to all properties that are maintained by the North Carolina Department of Cultural Resources. Those properties vary widely and include those properties that are historic and not historic; rural and urban; rehabilitated for uses other than what their original use was intended; and within various settings and microclimates from the Coastal Plain, through the Piedmont, to the Mountain region.

Of the properties where the plan applies, many are considered historic and their historic significance and features must be taken into consideration and protected when applying a maintenance regimen in order to preserve the integrity of the property. All landscape features within a historic property, whether the feature is generally considered historic or not, should be retained until the history of the landscape and the age of specific features can be documented in a Cultural Landscape Report (CLR). Action for specific features identified in a CLR will be addressed when a treatment (preservation, rehabilitation, restoration, or reconstruction) for the property is chosen. Extant features within the period of significance will be retained, whereas, missing features may be reconstructed, and later features outside the period of significance may be removed. The Landscape Management Plan is not meant to take the place of a Preservation Maintenance Plan (PMP), which is a maintenance plan for a specific historic site.¹

The plan can be implemented without regard to preserving the different site features at properties that are not considered historic. However, it should be remembered that even though a property may not be designated as historic, there are often key features within that landscape that are characteristic of that property. It is generally recommended that those special features in non-historic landscapes also be preserved.

Conversely, the plan should be implemented at properties where an historic designation may be considered in the future. If the spirit of the plan protects those resources that are not historic as of yet, the integrity of what may make the property historic in the future should be preserved. There is a long list of property owners whose properties were not considered eligible for listing in the National Register of Historic Places because of later changes to the property that affected its integrity.

For those properties designated as historic, users of this guide will undoubtedly find that goals of sustainability may at times come into conflict with the goals of historic preservation. It is these areas of overlapping interest where creative solutions will need to be formulated and executed. A property's historic designation should not preclude it from being maintained in an environmentally sensitive manner; however, the features of those historic properties should not be compromised as a result of implementing a sustainable landscape management plan. It is after all the aggregate of those features that characterize a property as historic, and as the trustee of many of the state's most significant historic properties, it is the charge of DCR to preserve and properly maintain those properties for future generations. The intent of the plan is not to be proscriptive, but to provide direction when making landscape decisions.

Within the boundaries of historic properties, there are frequently support areas that are not historic. Those support areas are often visually removed from the historic core and can be treated differently than the core. The integrity of the historic core should be given the highest priority, with the goal of ensuring an accurate interpretation of the site for all visitors. Support areas include, but are not limited to, parking lots, service roads, visitor centers that are not contained within historic buildings, and service buildings. A transition area will in all likelihood need to be made between the support areas and the historic core. Where there is little or no transition area between the support facilities and the historic core, a visual separation may need to be added where possible to safeguard the visitor's experience from within the historic core or to preserve the historic setting.

To illustrate the point, consider a historic property with a parking lot that is not visible from the historic core, and where there are no known archaeological or historic resources in or adjacent to the parking lot. Instead of re-creating a period landscape that never existed around a modern parking lot, the parking lot may very well be landscaped with plants to achieve a different goal such as screening the vehicles from the core or creating a four-season interest. Or, a particular location(s) between the parking lot and the historic core may be selected to educate visitors about how one may have arrived at the property historically. Pedestrian surfaces may even be treated differently within the core and the service areas. The historic core may have graded clay paths; whereas, the parking lot may utilize asphalt or concrete paving or less expensive compacted aggregates or even a consolidated soil treatment that utilizes the native soil. The latter may even extend into the historic core to help tie the site together and preserve the historic character. The parking area may receive a higher degree of maintenance, such as more frequent lawn cutting and the pruning of trees and shrubs to convey a sense of welcome to visitors. Such an action would in all likelihood stand in contrast to a more cluttered and less pristine yard where a deliberate attempt may be made to convey a sense of the true character of a working property from a specific period.

In addition to dividing the historic landscape into non-historic support area(s) and the historic core, the latter can often be further divided into different areas whose features vary. For instance, a historic house site may have a front yard, back yard, barnyard, vegetable garden, orchard, fields, and woodlands. Each area may very well be treated differently depending on the goals of the site, funding, maintenance staff, and equipment.

Many of these preservation and environmental goals will seem foreign to the visiting public; however, they should be regarded as opportunities to educate the public about the property and the plan. For example, visitors are accustomed to seeing many historic properties with manicured monoculture lawns instead of the more appropriate collection of native grasses and herbaceous plants in a less than pristine appearance. As a general note, the Office of Environmental Education (www.eenorthcarolina.org) within the North Carolina Department of Environment and Natural Resources can provide sources for environmental consultation. That same office also provides a PowerPoint presentation at www.eenorthcarolina.org/eecenters/ncaeec/outdoorsignspres.ppt for interpretive signs and exhibits. Users of the plan may also contact that department's Customer Service

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Center at www.envhelp.org, or at 1640 Mail Service Center, Raleigh, NC 27699-1640,
(877) 623-6748. General questions can be sent via e-mail to denr.csc@ncmail.net.

Specific Landscape Maintenance Issues

Lawn Maintenance:

- Selection of grass – The selection of the right grass and the proper maintenance of the grass can lead to a healthier lawn that does not require constant managing. Selection of a grass will depend upon the hardiness zone of the site, the microclimate of the site, the amount and degree of use (foot and equipment traffic), and the determination where, if any, areas of a historic site will be accurately depicted. More than one type or species of grass may be utilized at each location. The Romantic-era designers popularized the idea of the lawn, as we know it today, in the mid-nineteenth century. The modern notion of a lawn is foreign to most, if not all, of the department's historic sites, but applicable to the remaining sites.

Historically, most “lawns” were simply comprised of native grasses and herbaceous plants. European introductions, such as plantain, clover, and dandelion were also grown. These “lawns” were controlled by livestock, sheep, or goats, or mechanical means, such as scythes or mechanical and gas powered lawn mowers from the mid-nineteenth century to the present. The idea of a well-maintained lawn is typically an early- twentieth-century notion in North Carolina. The yards around early houses usually had swept yards where brooms were used to sweep the yards clean of everything – including the vegetation – for sanitary purposes. Adjacent work yards were often covered with grasses and native herbaceous material, and outlying fields were typically cultivated crops.

At historic properties, swept yards should be considered where historically appropriate and practical for today's use. Soil consolidants can be used to help stabilize soils and reduce maintenance in historic buildings. Yards that are adjacent to the house and main buildings should utilize grasses that are more durable to accommodate heavy foot traffic or naturally occurring herbs. The use of crops should be considered in fields where appropriate and manageable. Long-term leases granted to local farmers can help provide the historic backdrop to many of DCR's historic sites. In historic applications, caution should be taken not to convey a false historic appearance.

Non-historic properties should follow generally accepted guidelines when selecting grass specie(s). The selection of a grass will depend more on the zone, microclimate, and degree of use. Grasses that require less maintenance should be considered over grasses that require more maintenance. In addition, grasses that require less supplemental watering or irrigation are preferred over those grasses that require more. The use of drought resistant grass without irrigation systems will save on construction costs, maintenance costs, and water costs.

Departmental Examples:

1. Aycock Birthplace, Fremont vicinity, Wayne County. The Division of State Historic Sites sweeps the front yard of the house as part of its maintenance regimen to provide a historic setting for the house. This has the added benefit of reducing the amount of grass that gets cut and slightly reducing the fuel, maintenance, and labor expenses for mowing.
2. Bentonville Battlefield, Four Oaks vicinity, Johnston County. The Division of State Historic Sites leases between 200 and 250 acres out of the total landholdings of 640 acres to farmers to continue farming the land. This has the added benefit of maintaining the agricultural setting of the historic landscape as it is interpreted to the visitor.
3. North Carolina Museum of Art, Raleigh, Wake County. The museum is establishing a native Piedmont prairie ecosystem composed of native grasses and wildflowers on twenty acres of pasture adjoining the museum. Construction of a one-acre test plot began in February 2006. Progress on the test plot will be monitored throughout the year, and reestablishment of the prairie habitat on the remaining nineteen acres will be forthcoming. Future maintenance of the prairie will include a burn test to simulate natural events in the reconstructed habitat.

Additional Information:

1. A copy of *Organic Lawn Care: A Guide to Organic Lawn Maintenance and Pest Management for North Carolina* can be ordered for \$4.00 a copy from The Department of Agricultural Communications, Campus Box 7603, North Carolina State University, Raleigh, NC 27695-7603 or downloaded online at www.turffiles.ncsu.edu/pubs/management/lawns2.pdf.
 2. *Carolina Lawns* is available at www.turffiles.ncsu.edu/pubs/management/ag69.html.
 3. Visit the North Carolina Cooperative Extension Service at www.ces.ncsu.edu/ or www.ces.ncsu.edu/counties/ for specific county contact information.
- Mowing – Historic properties should reflect their historic appearance instead of today’s aesthetic of well-manicured lawns. As stated above, most “grassed” areas were generally fields of native grasses and herbaceous plant materials or European introductions where animals or mechanical systems were utilized to control the height of the grass. Closer to the house or main work yards, the soil may have been swept

clean to prevent any vegetation from growing, or the “grass” may have been more frequently and better maintained by grazing animals or mechanical means.

The fields and many of the work yards generally received less maintenance than the yards around the main buildings. Thus a hierarchy was reinforced by historic maintenance cycles. Today’s maintenance of outlying areas should reflect the lack of a frequent cyclical maintenance program. Adopting such methods will extend maintenance funds as well as provide a more accurate interpretation of the historic site. Maintenance cycles at non-historic properties should follow commonly accepted guidelines.

Frequency of mowing during the grass-cutting season will depend upon the grass species, health of the grass, soil fertility, amount of rain, irrigation practices where applicable, maintenance budget, equipment, microclimate(s) within a site, and most important the interpretation of the site. Grass should only be mowed when dry. This will provide a better cut by the mower, allow for a better distribution of clippings, and enable a quicker decomposition of clippings. Grass clippings should not be bagged, but they should be allowed to decompose to help fertilize the soil. The process of leaving clippings on the lawn to decompose is known as grasscycling and it is an environmentally friendly process. In addition to fertilizing the soil, grasscycling also saves time and money in collecting the clippings, enhances the water holding capacity of the soil, slows the rate of evaporation from the soil, increases plant drought tolerance, and conserves water.²

Some warm season grass perform best if cut by a reel mower instead of a centrifugal mower. Cutting blades should always be sharp. Dull blades tear the grass instead of making a clean cut. This can lead to easy access for pathogens. Sharp blades can also result in extending the life of the mower and reducing fuel consumption.³

The only grass clippings that should be moved are those that end up on parking lots, sidewalks, or other paved surfaces. Those clippings should be blown back onto the grassed areas so that the clippings can decompose and provide nutrients to the grass. Clippings should not be bagged nor should they be blown into the street where they can clog municipal storm sewers. It should be noted that lawn maintenance should be undertaken before or after the site is open to the public so as not to diminish the experience of the visitor.

The frequency of mowing at non-historic properties will depend upon the grass species, health of the grass, soil fertility, amount of rain, irrigation practices where applicable, maintenance budget, and equipment. As with historic properties, the grass at non-historic properties should only be mowed when dry, a grasscycling policy should be instituted, and blades should be sharpened on a regular basis. However, unlike historic properties that are open to the public for interpretive purposes, the timing of routine lawn maintenance at non-historic properties is not generally regarded as an issue unless a specific function may be disturbed.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites has the grass cut before 9:00 a.m. so as not to diminish the visitors' experience. In addition, grasscycling is practiced in most lawns. The replenishment of nutrients into the soil has "for the most part" eliminated the need to fertilize those lawns.
2. North Carolina Museum of Art, Raleigh, Wake County. The museum is establishing a native Piedmont prairie ecosystem composed of native grasses and wildflowers on twenty acres of pasture adjoining the museum. Construction of a one-acre test plot began in February 2006. The remaining nineteen acres will be reestablished upon evaluation of the test plot. In addition to the environmental and education benefits, the parcel will no longer require regular mowing – although a completely different set of maintenance requirements, such as controlled burns, will be employed.

Additional Information:

1. A copy of *Organic Lawn Care: A Guide to Organic Lawn Maintenance and Pest Management in North Carolina* can be ordered for \$4.00 a copy from The Department of Agricultural Communications, Campus Box 7603, North Carolina State University, Raleigh, NC 27695-7603 or downloaded online www.turffiles.ncsu.edu/pubs/management/lawns2.pdf.
 2. *Carolina Lawns* is available at www.turffiles.ncsu.edu/pubs/management/ag69.html.
 3. The topic of grasscycling is available at www.turffiles.ncsu.edu/pubs/management/gc592.html and at www.ciwmb.ca.gov/organics/GrassCycling/.
- Selection of Lawn Maintenance Equipment – Environmental considerations should be considered when purchasing new lawn maintenance equipment. Hour for hour, gas-powered lawn mowers produce more pollutants than a vehicle. Lawn mowers and other small-engine equipment, such as blowers and weed trimmers, with low emissions engines should be considered over those with no special provisions. Technology of fuels and small engines is being updated to produce fewer pollutants.

Electric mowers should also be considered for smaller sized lawns where less than two inches of grass or one-third of the height of the grass is cut at each mowing. Mulching mowers or reel mowers should also be considered. The latter may be appropriate for some of DCR's historic sites, such as the Thomas Wolfe Memorial in Asheville. Using period-appropriate maintenance can enhance the visitor's

experience, and reduce maintenance expenses for small engine repair. Mulching mowers cut the grass blades into finer pieces, which allows the debris to filter to the ground faster. Mulching mowers may be better suited for sites where grass cutting is not done on a regular basis.

Electric weed trimmers and blowers are also preferred over gas-powered models. Electric models are typically lighter and therefore easier to maneuver. Battery powered equipment is also another option. The time of operation for battery powered equipment has increased in recent years; therefore, larger grassed areas can be cut on a charged battery. If multiple batteries are purchased, outlying areas can be completed before running out of a fuel source.

The use of small engine equipment, such as lawn mowers and weed trimmers, around buildings, objects, and vegetation should be discouraged. This is especially true for those that are historic. Buildings, objects, and vegetation can be marred by the use of mowers and trimmers at their base. There are countless examples of damage where lawn mowers have struck the base, and examples of where weed trimmers have eroded the base of a building or object or opened a gash in the bark of vegetation. Fences, grave markers, and other frequently difficult to reach locations are especially susceptible to damage by weed trimmers. As previously stated, lawn maintenance should be undertaken before or after the site is open to the public so as not to diminish the experience of the visitor.

At non-historic buildings, manufactured edging can be installed to protect the building, object, and vegetation, or plant material can be installed to keep the equipment at bay. Where there is a historic building or object, mowing should be reduced in frequency to reflect a more accurate depiction of the historic resource, or period-appropriate groundcover should be planted at the base of the building or object. If the area is small enough, hand clipping may be more appropriate. Some historic sites, as stated above, may even consider installing swept yards or using sheep or goats to control the grass. Installing rubber bumpers on lawn mowers and using nylon weed trimmers will help somewhat; however, a false sense of security should not be gained because of the negative cumulative effect on the historic resource.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites uses bare and mulched areas as buffers between lawns and trees to prevent damaging of tree bases when cutting grass.

Additional Information:

1. "Lawn Care Equipment" is available at www.care2.com/channels/solutions/home/49.

2. *Preservation of Historic Burial Grounds*, The National Trust for Historic Preservation. Information Series No. 76, 1993.
3. *A Graveyard Preservation Primer*, Lynette Strangstad, The American Association for State and Local History, 1988.

Irrigation/Watering:

- Introduction – Irrigation can be a divisive issue when planning and maintaining landscapes. Irrigation is a relatively new technology and a luxury. Historically, container plants and greenhouse plants were certainly watered when water was made available; however, water for newly installed plant material was dependent upon an owner's ability, willingness, and wherewithal to collect and distribute the valuable resource. Historically, it is inconceivable to believe that established plants within the landscape received regular waterings.

Departmental use of irrigation systems is strongly discouraged since North Carolina recently came out of a four-year drought in 2002 where the governor issued executive orders limiting state agencies' use of water. In addition, irrigation systems represent a budgetary line item that is quickly becoming a luxury. Installation, maintenance, and water costs are extravagant costs to bear in a time when basic needs and maintenance cannot be met.

The need for irrigation systems and supplemental watering can greatly be reduced or eliminated by selecting the proper plant(s). This is true for historic sites where irrigation systems were never used and where appropriate plant selections were made. Non-historic properties should also be discouraged from becoming dependent on the use of irrigation systems by making proper plant selections. Special provisions can be made for periods of drought if water is available. However, it should be remembered that as demand for water increases, availability of water would in all likelihood diminish or be restricted – thus negating the need for such a system at the most critical time.

In historical settings, appropriate plant selection, which should negate the need for an irrigation system, is important. Only plant species or varieties known to have existed on site or those available at the time should be considered for planting. Most historic species or varieties were regionally available and should perform well – even during most droughts. Most native species will go dormant when faced with drought conditions. However, it should be remembered that the best horticultural attempts in establishing plants – be they historic or not – often result in failure.

As stated above, plant selection is also important when working with properties that are not historic. Native species and those plants that perform well in the region should be selected over those that are not native and do not perform well in the region and will require supplemental watering and maintenance.

As a note, certain land disturbing activities, such as the installation of an irrigation system, may necessitate consultation with the North Carolina State Historic Preservation Office (HPO). Consultation with the HPO is required, according to Section 106 of the National Historic Preservation Act of 1966, G.S. 121-12(a), and Executive Order XVI, when a project has an effect on a property that is listed in or may be eligible for listing in the National Register of Historic Places and when that project uses or requires federal or state funding, license, permit, or approval.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites has installed an in-ground irrigation system for new plantings in the Kitchen Garden and the Stoney Flower Garden. This system is also used when rainfall is less than one inch per week. Established trees, shrubs, and turf do not receive supplemental watering.
2. North Carolina Museum of Art, Raleigh, Wake County. The museum plans to divert the existing runoff from the parking lots and building into a new underground storage tank. That water will then be used to irrigate new plantings that will be terraced along a new stormwater retention pond that will collect runoff from future building construction.

Additional Information:

1. "Efficient Irrigation" (publication AF-508-6) is available at www.bae.ncsu.edu/programs/extension/publicat/wqwm/ag508_6.html. Additional water conservation articles can also be accessed through the North Carolina Cooperative Extension Service at www.bae.ncsu.edu/programs/extension/publicat/wqwm/index3.html.
 2. Also see plant selection section.
- Alternatives – Different types of watering systems that use less water should be investigated. Sprinkler systems, be they an elaborate underground piping system with pop-up heads or simply garden hoses with attachments, waste more water because of evaporation, misdirected spray, over spray, and runoff when excessive amounts of water are deposited in a particular location. More efficient irrigation systems include hand watering or the installation of a drip irrigation system or a field pipe system. These systems place the water where it is needed, instead of broadcasting it through the air, and result in less waste. These systems are recommended for watering trees, shrubs, and flower (annuals and perennials) beds, but not for lawns. These systems can easily be adapted and installed when establishing new vegetation. In addition, they can easily be removed at any point since they can be temporary.

Hand watering, although not a highly efficient use of a limited labor supply, should be used during drought periods when plants begin to show signs of distress. A slow stream of water applied through a nozzle that distributes the water via smaller droplets is more efficient than sprinkler systems. For additional information, see the article “Efficient Irrigation” listed below under the Additional Sources section.

Drip irrigation systems distribute water through flexible pipes. These systems typically use 30 to 50 percent less water than sprinkler systems and they cost less to install. Proper spacing (usually within 12 to 18 inches) can sufficiently wet an area. For smaller areas, soaker hoses can also be used. Both the flexible pipe and the soaker hose are placed on top of the ground; therefore, precautions may be needed to conceal them. At historic properties, a fabric filter may have to be wrapped around the pipe or hose and covered with soil. At non-historic properties, a layer of mulch can be placed on top of the pipe or hose.

The use of a field pipe system should be considered as an alternative to a permanent irrigation system – especially when property managers want newly planted vegetation to become established. A field pipe system is simply an irrigation system that runs on top of the ground. The field pipe system can be hidden with mulch, and spigots can be installed where necessary. In addition, the entire system can easily be removed once the plants are established, and the maintenance costs of a permanent system can be eliminated. This approach was undertaken at Fairsted – The Frederick Law Olmsted National Historic Site in Brookline, Massachusetts.

In some instances, water can be recycled for use or collected in non-conventional methods. Examples include recycling wastewater from buildings and collecting rainwater into cisterns. In the past, some property owners have attempted to reuse household water for watering plants. The reuse of untreated water – be it bathwater, dishwater, or water from a washing machine – within the landscape or building(s) is not permitted under current North Carolina law. However, wastewater can be reused if Reclaimed Water Standards are met. The Standards are not proscriptive, but set minimum thresholds for treating water before it is reused. The Non-Discharge Permitting Unit of the Division of Water Quality in the Department of Environment and Natural Resources is responsible for permitting of all wastewater that is not discharged into surface waters or septic systems. Alternative methods of recycling wastewater include package plants or constructed wetlands. In the latter, a sand filter and vegetation filter disinfect and store wastewater for reuse in irrigation or flush water in toilets.

Properties may need to be prioritized into zones where different treatments are acceptable. For instance, a kitchen garden at a historic site may require supplemental watering; whereas, established period plants – especially those further away from the water source – should be able to withstand most drought conditions. Supplemental watering will need to be provided to ornamental plants (trees, shrubs, and herbs) and turfgrass during their first growing season (the first 8-10 weeks after transplanting).⁴

When irrigation systems are installed, follow commonly accepted practices when watering. Frequent and short waterings will result in shallow root systems that may result in the death of the plant during severe droughts where irrigation is regulated or not permitted.

Cisterns offer a viable alternative for collecting rainwater for use in the landscape. Cisterns can be used to collect water for landscape uses as long as they are removed from possible sources of contamination and if they are not subject to flooding. Some historic properties had or may still have cisterns that may be utilized in the landscape today. Historic cisterns may need to be rehabilitated before being put back into service. If rehabilitation work is required, the work should meet the *Secretary of the Interior's Standards for Rehabilitation* and consultation with the State Historic Preservation Office (HPO) may be required. The reuse of historic cisterns can even be incorporated into the interpretive tour at the DCR's historic sites, where applicable. County health offices may need to be consulted prior to undertaking work.

As a note, certain land disturbing activities, such as the installation of an irrigation system or the repair of a historic cistern, may necessitate consultation with the North Carolina State Historic Preservation Office. Consultation with the HPO is required, according to Section 106 of the National Historic Preservation Act of 1966, G.S. 121-12(a), and Executive Order XVI, when a project has an effect on a property that is listed in or may be eligible for listing in the National Register of Historic Places and when that project uses or requires federal or state funding, license, permit, or approval.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites hand waters several flower beds when plants show signs of stress from drought. In addition, new perennial beds receive supplemental watering by using soaker hoses. Once the plants are established after a year, the soaker hoses are removed. Both methods reduce the amount of water that is wasted. Established trees, shrubs, and turf do not receive supplemental watering.

Additional Information:

1. "Efficient Irrigation" (publication AF-508-6) is available at www5.bae.ncsu.edu/programs/extension/publicat/wqwm/ag508_6.html. Additional water conservation articles can also be accessed through the North Carolina Cooperative Extension Service at www.bae.ncsu.edu/programs/extension/publicat/wqwm/index3.html.
2. Contact the Non-Discharge Permitting Unit of the Division of Water Quality within the North Carolina Department of Environment and

Natural Resources for all permitting of wastewater that is not discharged into surface waters and septic systems. Phone number is (919) 733-5083 and web address is <http://H2o.enr.state.nc.us/ndpu>.

Fertilization:

Plants, including both ornamentals and turf, often cannot retrieve enough nutrients from the soil for adequate growth. Plants may need assistance in making more nutrients available to sustain viability. Reasons for supplementing soil nutrients may include: the existing soil may be denuded of nutrients when the topsoil is stripped during a particular construction project; the ornamental plants and turf may be competing for the limited amount of nutrients; and encroaching impervious surfaces or compacted soil may affect a plant's health. If the site is denuded of topsoil, compost or other organic matter may need to be added and mixed into the remaining soil to improve moisture and nutrient retention of the soil.

Maintaining healthy plantings, both ornamentals and lawn, is important in preventing disease and insect damage. Proper fertilization is an important step in building healthy soils and plants. The improper use of fertilizers can actually damage the soil and plants and make them more susceptible to disease and insect damage. Fertilizers can damage plants by burning them as well as introducing weed seed, which will compete with plants for available nutrients. Special care must be taken when using organic fertilizers.

Soil pH also plays an important role in the ability of a plant to take up nutrients. The pH requirements for ornamentals and turf are usually not the same. Therefore, soil pH where ornamentals and turf meet may always be fluctuating. Trees generally require a pH range of 5.2 to 6.2;⁵ whereas, lawns usually require a pH close to 6.5.⁶

A professional arborist should be consulted for valuable and historic specimens if a professional arborist or horticulturist is not on staff. An inspection can result in specific recommendations that will improve the health of the specimen and extend its longevity.

For planting beds, it is best to properly prepare the soil to ensure that there is a good mixture of air, water, and nutrients from the outset. This may require that the soil be amended with organic material to achieve a more balanced relationship between pore space and soil particles. Both air and water are contained in the pore space of the soil. Sandy soils dry out quicker; whereas, clay soils retain water longer. Ideal planting bed conditions require a good balance to maintain a healthy balance of adequate air and water in the soil.

Soil testing is an important step in determining an appropriate solution. The North Carolina Department of Agriculture can analyze soils and make recommendations for specific plantings. See the Additional Information section for contact information. An appropriate amount of time should be included for the actual testing of samples.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites conducts routine soil tests every two to three years or before a new plant installation is made. This allows fertilizer applications to be tailored according to the needs of individual plants. In addition, a slow-release fertilizer is applied once or twice a season (depending on the plant) to provide a more even distribution of nutrients.

Additional Information:

1. "Fertilizing Deciduous Shade Trees in the Landscape" is available at www.ces.ncsu.edu/depts/hort/hil/hil-618.html.

Pathogen/Pest Control:

Plant pathology (the study of plant disease) and entomology (the study of insects) are endemic professions. Most property managers or owners do not have the expertise to (1) properly diagnose plant diseases or insect damage, (2) investigate the environmental conditions that may contribute to a plant's susceptibility to disease or insect damage, or (3) prescribe acceptable solutions regarding plant disease, insect damage, or environmental conditions. Some properties may actually have a professional horticulturalist, pathologist, or entomologist on staff or access to such a professional.

A plant's environment should be seriously analyzed when investigating plant diseases or insect damage. A plant that is located in less than ideal conditions or one that is suffering from undue stress will be more susceptible to an opportunistic disease or insect. It should be remembered that the environmental factors might be the primary contributor to a plant's poor health.⁷ A trained professional should be consulted to analyze the environmental conditions and how to ameliorate those conditions.

Sustainable solutions include correcting or changing environmental conditions, making appropriate plant selections, implementing integrated pest management systems (IPM), developing or applying environmentally friendly chemical treatments, and studying biotechnology solutions that avoid resistance to treatments. Improper treatments may not actually solve the problem, but instead may exacerbate the problem, hinder the investigation of the problem and subsequent discovery of a solution, harm the environment, or contribute to the resistance of the pathogen to the treatment that was implemented. Generally accepted treatments, such as chemical sprays, may also negatively affect other flora or fauna. Care must be taken not to compromise the integrity of character defining materials if sustainable solutions are undertaken at historic properties.

Native plant selection should be given preference unless the use of non-native ornamental plantings can be documented. Generally speaking, native plant selections should be

hardier and less susceptible to pathogen attacks, and therefore, require less maintenance. Refer to the Plant Selection section for a discussion about plant substitution.

Property owners and managers with specific plant disease or insect problems should contact their county extension office first. A second alternative is to contact the Plant Disease and Insect Clinic (PDIC) at North Carolina State University (see the Additional Information section below) in Raleigh. The local extension office and the PDIC can identify specific plant disease(s) or insect infestation, and recommend a safe treatment. A cost savings may be realized at the PDIC if the county extension office contacts the PDIC on behalf of the property owner or its agent.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites employs an integrated pest management system (IPM) for all pathogen and pest problems. The greenhouse operation uses a dilute bleach solution to clean recycled pots, and diseased plants are regularly culled and properly disposed of. In the gardens, diseased annuals and vegetables are also culled and properly disposed of; however, fruit trees and grapes are not sprayed with insecticides or fungicides for the purpose of conveying a true appearance of their eighteenth and nineteenth century condition to the visitor. An organic insecticide *Bacillus thuringiensis* is applied to caterpillars on vegetable crops; however, Acephate is used to treat fire ant mounds because of the threat to visitors.

Additional Information:

1. Visit the North Carolina Cooperative Extension Service at www.ces.ncsu.edu/ or www.ces.ncsu.edu/counties/ for specific county contact information.
2. "Plant Pathology" is available at www.hcs.ohio-state.edu/mg/manual/path.htm.
3. "Plant Disease and Diagnosis and Management" is available at www.ag.uidaho.edu/mg/handbook/MGH05_12.pdf.
4. "Plant Disease Information Notes" is available at www.ces.ncsu.edu/depts/ent/clinic/indexa.html.
5. "Insect Notes" is available at www.ces.ncsu.edu/depts/ent/notes/.
6. See the Insect Identification Laboratory at Virginia Tech at <http://www.ento.vt.edu/Facilities/OnCampus/IDInfo.html>.

7. Turfgrass Disease Information Notes is available at www.ces.ncsu.edu/depts/pp/notes/Turfgrass/turfgrass_contents.html.
8. See the North Carolina State University Plant Disease and Insect Clinic at www.ces.ncsu.edu/depts/ent/clinic.

Weed Management:

Uncontrolled weed growth can greatly affect the health of lawns, herbs, and woody plants by competing for light, water, and nutrients. Property managers can never truly expect to control weeds; however, the management of weeds is a more realistic expectation. The management of weeds in the landscape will likely involve several measures. The first step is to identify the weed species so that its life cycle and applicable control measure(s) can be formulated. As with plant pathology and entomology, the study of weeds and their management is also an endemic profession. Property owners and managers without professional staff should seek assistance. The Cooperative Extension Service (administered through North Carolina State University) maintains a source list of weed identification guides. Refer to the Additional Information sub-heading at the end of this section.

Young weeds should be pulled by hand or cultivated with a tool before employing alternatives. Early removal should occur before plants are established and before plants set seed. Once established, weeds will compete with existing vegetation and they will require more effort to eliminate. Be aware that cultivation may not kill the weed if enough of the root remains in place. In addition, cultivation will bring new seed to the surface where it too will sprout. Therefore, cultivation is a cyclical process.

Chemical treatments may be necessary when mechanical removal through volunteer or paid labor is not a practical option. Chemical treatments include both preemergence and postemergence herbicides or a combination of both. As expected, chemical treatments are quite specific, and directions must be carefully followed. Factors to consider when selecting a chemical and application rate include plant species in the affected planting bed or area (turf, annual, perennial, or ornamental), the type of weed, and the effect of any lingering chemicals in the soil. It should be noted that a North Carolina commercial pesticide applicator's license is required when spraying any pesticide on the job, for which one is being paid.

The weed management process should be investigated prior to selecting a site for a new planting bed or lawn. Proposed planting sites should be properly assessed and the site thoroughly prepared for the new plantings so that they can be established as soon as possible and ward off any potential weed problems. Many new planting beds may need to have weeds mechanically or chemically treated prior to preparing the soil for the new plantings. Fumigation may be a treatment option for large areas that are scheduled to be planted. Chemical applications should follow manufacturer's directions to avoid harm to

the environment and the applicator. An improper use or rate of application of chemicals can kill many of the beneficial organisms found in ornamental plantings and lawns.

Mulches should be employed to reduce the number of weeds germinating. Organic mulches, which include shredded bark, pine bark or needles, and leaves, are the most commonly used mulches; however, inorganic mulches, which include gravel, stone, or plastic sheathing used with stone or gravel, may also be considered. The use of inorganic mulches in historic settings should be verified before installation. Stone, gravel, or crushed shells were often used for paths in gardens. Archaeology and photo documentation can be used to locate any such installations. It should be noted that plastic sheathing would inhibit water and air movement, which will adversely affect plant growth. Organic mulches should be considered when historically appropriate and for areas outside of the historic core. However, alternative methods for weed control should be considered for the historic core where mulch was not used. Volunteers may be solicited to assist in the weeding or a chemical treatment regimen may be employed. Non-historic applications will allow for more leeway; however, pine straw is not the mulch of choice since it is raked from the pine forest floor, which can result in erosion.

As a note, certain land disturbing activities, such as digging in an historic garden, may necessitate consultation with the North Carolina State Historic Preservation Office (HPO). Consultation with the HPO is required, according to Section 106 of the National Historic Preservation Act of 1966, G.S. 121-12(a), and Executive Order XVI, when a project has an effect on a property that is listed in or may be eligible for listing in the National Register of Historic Places and when that project uses or requires federal or state funding, license, permit, or approval.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites employs hand cultivation and mulching to reduce weed populations throughout the gardens. Glyphosate (Roundup) is occasionally used on paths and larger informal areas in the Wilderness Garden.

Additional Information:

1. Visit the North Carolina Cooperative Extension Service at www.ces.ncsu.edu/ or www.ces.ncsu.edu/counties/ for specific county contact information.
2. See the Weed ID Guides compiled by North Carolina State University Cooperative Extension Service at www.ces.ncsu.edu/depts/hort/weeds/weedgid.html.
3. “Weed Management in Annual Color Beds” is available at www.ces.ncsu.edu/depts/hort/hil/hil-8644.html.

4. “Weed Control in Vegetable Gardens” is available at www.ces.ncsu.edu/depts/hort/hil/hil-8101.html.
5. “Weed Management for Wildflowers” is available at www.ces.ncsu.edu/depts/hort/hil/hil-645.html.
6. See the University of California-Davis Weed Photo Gallery at http://www.ipm.ucdavis.edu/PMG/weeds_common.html.
7. “Weed Management in Lawns” is available at www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74113.html.
8. See the Virginia Tech Weed Identification Guide at <http://ipm.ppws.vt.edu/weedindex.htm>.

Organic Material Disposal:

When organic material, such as leaves and branches, is collected, it should be properly disposed of or composted for future use as mulch or soil additives. Open burning is permitted only for organic material where local pick up is not available. All other open burning violates the state’s open burning rules. Local governments may also have added restrictions regarding open burning.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites collects and transports all organic waste material from the site to the city’s waste recycling center where it is recycled as compost. The division also uses the compost to amend the soil in garden areas.

Additional Information:

1. Download the “Breathe...Don’t Burn!” brochure from the North Carolina Division of Air Quality at <http://daq.state.nc.us/news/brochures/openbur.pdf>.
2. For additional information about composting, see the North Carolina Division of Pollution Prevention and Environmental Assistance at <http://www.p2pays.org/compost/>.
3. For additional information about recycling and waste reduction, see the Division of Pollution Prevention and Environmental Assistance website at <http://www.p2pays.org/>.

Stormwater Management and Nonpoint Source Water Pollution:

Polluted runoff, also called nonpoint source water pollution, is considered the main cause of water pollution in North Carolina. Sources of nonpoint water pollution include land-disturbing activities that cause erosion and sedimentation, impervious surfaces that collect and dump concentrated pollutants, and fertilizer, herbicide, and pesticide application. Rainwater and irrigation systems are the two main vehicles for transporting pollutants into the state's water systems.

Sediment is the number one pollutant, by volume, in North Carolina. The North Carolina Sedimentation Pollution Control Act of 1973 (G. S. 113A-57) requires that disturbances larger than one acre must take special precautions to reduce soil erosion and prevent sedimentation damage to waterways and property. The statute further states that an erosion control plan must be filed with the state at least 30 days before the land disturbing activity and that the plan must be approved before the land disturbing activity can begin.

Possible solutions to manage and filter runoff, erosion, and sedimentation include constructing vegetative buffers, rain gardens, wetlands, and green roofs, and installing pervious pavements. However, in historic applications, care should be taken not to convey a false historic appearance.

The proper use and rates of herbicides, pesticides, and fertilizers will aid in reducing nonpoint source pollution. For additional information refer back to the Fertilization and Pathogen/Pest Control sections.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites has reduced overall pesticide and fertilizer use to comply with the recently adopted Neuse River rules. In addition, the division is overseeing the reconstruction of two new wetlands to filter stormwater from the historic site and adjacent residential areas. That project is scheduled for completion in July 2006.
2. North Carolina Museum of Art, Raleigh, Wake County. The museum is planning for a future building campaign that will include a new stormwater retention pond and surrounding plantings on terraces. Plantings from a similar native ecosystem will be grouped together on various terraces that surround and rise above the retention pond. Stormwater runoff will be filtered as it passes through the various terraces as well as the retention pond. The pond is expected to be approximately one acre in area and the surrounding plants approximately six acres in area.

3. North Carolina Maritime Museum, Beaufort, Carteret County. The museum, the museum support group, and several state and federal agencies collaborated on the restoration and stabilization of the Newport River shoreline. Building debris and waste shells were removed, and the Saltmarsh Cordgrass *Spartina alterniflora* was reestablished. The grass helps to filter runoff, protect the shoreline, and provide a habitat for fish and wildlife at both high and low tides.

Additional Information:

1. The Division of Land Resources, Land Quality Section of the North Carolina Department of Environment and Natural Resources (DENR) maintains a staff of engineers, geologists, and technicians across the state to ensure compliance with erosion and sedimentation control requirements. Visit the agency at www.dlr.enr.state.nc.us/pages/sedimentation.html.
2. See DENR's Stormwater and Runoff Pollution website at www.ncstormwater.org.
3. "Discover North Carolina's River Basins" is available at www.eenorthcarolina.org/public/ecoaddress/riverbasins/riverbook.pdf.
4. Visit North Carolina State University's Biological and Agricultural Engineering Department's Urban Stormwater Management program at <http://www.bae.ncsu.edu/people/faculty/hunt/ag588-15.pdf>.
5. Visit North Carolina State University's Cooperative Extension Publications website for additional articles about stormwater control at <http://www.ces.ncsu.edu/Publications/environment.php#resource>.

Plant Selection:

New plantings should occur during the best environmental conditions for individual plants so that the plant's health is not unduly compromised during abnormal weather patterns, such as drought, excessive rainfall, high or low temperatures, or excessive temperature fluctuations. Such environmental strains can also make the plant more susceptible to pest infestation. Generally speaking, native plant selections should be hardier and less susceptible to pathogen attacks, and therefore, require less maintenance. It should be remembered that non-indigenous plants could actually become pests themselves. If environmental conditions are optimal, these plants can become invasive and compete with and frequently eliminate native plant species.

In non-historic locations, the use of native plant materials should take precedence over non-native plants. Generally speaking, the use of native plant material should prove to require less maintenance. For instance, supplemental water should only be necessary in

times of drought. Most native species will go dormant when faced with drought conditions. In addition, most native plant material should be more resistant to pests and therefore require fewer pest treatments. Exceptions can be made for non-invasive plant species provided that adequate maintenance and training for grounds crews is provided.

Plant selections at historic properties should be based on scholarly research where specific plant species or varieties were known to have been planted or where historically appropriate plantings are selected to achieve the intended landscape effect. Historic properties should only use plant species or varieties known to have existed on site at a particular time. Most historic plant species and varieties – both native and non-indigenous – should perform well during times of environmental strain; however, many historic plant species and varieties that were introduced have failed and will never acclimate themselves to the native environment. In the case of failed plant species and varieties, substitute material should be used. Substitute plant material may include different plant species or varieties that were generally available in the region at the time or a substitute plant that exhibits similar characteristics to the documented plant.

When selecting a plant substitute, specific characteristics of the substitute plant should closely match or duplicate those physical characteristics of the historic plant as closely as possible. Specifically, the type of plant (tree, shrub, groundcover, grass, annual, biannual, perennial, or vine) and its size, shape, form, branching habit, density, texture (with and without foliage), leaf (shape, size, texture, and color throughout all four seasons), flower (size and color and even blooming period and fragrance), fruit (type, size, and color and even the period for bearing), bark (color and texture), should closely match the historic plant.

In addition to closely matching the physical characteristics of the historic plant material, substitute plant material should also be able to capture the feel of the design intent of the historic plant material as meant by the designer or property owner. Substitute plant material should restore the historic visual and spatial relationships within the landscape between the plants and other site features. Plants can be used for ornamental or utilitarian purposes. Ornamental purposes for planting may include focal points, allees, or planting beds to mention but a few. Utilitarian uses of plants may include hedges to separate different uses within the cultural landscape, food production (crops and orchards), screening or shading, and much more.

In a historical context, one must weigh the options of substituting historic plants with tailoring the environment to better suit the plant. If the historic plant was long-lived, a substitute plant is most likely unnecessary. Before a historic plant dies, the possibility of propagating that plant through cuttings and to a lesser degree seed stock should be undertaken. However, if the historic plant was short-lived in its historic context, the possibility of installing a substitute plant should be considered. If plant substitutions are made, they should be noted at historic properties so as not to mislead the visiting public. However, it should be remembered that the best horticultural attempts in establishing plants – be they historic or not – often result in failure.

When a plant's longevity is shortened because of changes in its environment, one may want to consider returning the environment back to its original condition or reducing the impact of the change on the environment. For instance, runoff may be increased to downhill trees if a swept yard is treated with a soil consolidant in an effort to reduce maintenance costs. A possible alternative may be to install a shallow swale or dewatering system to remove the excess runoff before it reaches the trees. Another example may be the addition of a structural soil around tree roots where a path receives more foot and/or vehicular traffic. The expense of the work and maintenance costs and the availability of qualified workers are factors to consider. Whatever solution is chosen, great care should be taken not to give a false impression to the visiting public at historic properties.

As noted above, appropriate plant selections should require fewer treatments for pest infestations. In addition, plants that are native or acclimated to their environment should not require routine supplemental water. Therefore, proper plant selection may result in a significant savings by not installing irrigation systems and implementing pest eradication maintenance programs. Reduction or elimination of spray programs can result in a significant savings in labor; whereas, not installing irrigation system(s) can result in a savings in installation and materials, water costs, sewer costs in urban areas, and maintenance for the system.

As a note, certain land disturbing activities, such as planting or removing a tree, may necessitate consultation with the North Carolina State Historic Preservation Office (HPO). Consultation with the HPO is required, according to Section 106 of the National Historic Preservation Act of 1966, G.S. 121-12(a), and Executive Order XVI, when a project has an effect on a property that is listed in or may be eligible for listing in the National Register of Historic Places and when that project uses or requires federal or state funding, license, permit, or approval.

Departmental Examples:

1. Tryon Palace Historic Sites & Gardens, New Bern, Craven County. The Division of State Historic Sites uses historic and native species of flowers, shrubs, and trees to assist in the interpretation of the historic site. Newer cultivars that closely resemble the historic plant are often substituted for improved disease resistance.
2. North Carolina Museum of Art, Raleigh, Wake County. The museum is establishing a native Piedmont prairie ecosystem composed of native grasses and wildflowers on twenty acres of pasture adjoining the museum. Construction of a one-acre test plot began in February 2006. Progress on the test plot will be monitored throughout the year, and reestablishment of the prairie habitat on the remaining nineteen acres will be forthcoming.
3. North Carolina Museum of Art, Raleigh, Wake County. The museum is planning for a future building campaign that will include a new

stormwater retention pond and surrounding plantings on terraces. Plantings from a similar native ecosystem will be grouped together on one of three different terraces that surround and rise above the retention pond. The first terrace will be comprised of wetland plantings, followed by perennials and shrubs, and the third terrace will be comprised of Longleaf Pine. Stormwater runoff will be filtered as it passes through the various terraces as well as the retention pond. The pond is expected to be approximately one acre in area and the surrounding plants approximately six acres in area.

Additional Information:

1. See the Seed Savers Exchange at www.seedsavers.org/.
2. “Landscaping for Wildlife with Native Plants” is available at http://www.ces.ncsu.edu/nreos/forest/pdf/ag/ag636_03.pdf.
3. See several Plant Fact Sheets that are available through the North Carolina State University Cooperative Extension Service at www.ces.ncsu.edu/depts/hort/consumer/factsheets/.
4. “Drought-Tolerant Plants for North Carolina Landscapes” is available at www.bae.ncsu.edu/programs/extension/publicat/wqwm/ag508_3/.
5. The Southern Garden History Society www.southerngardenhistory.org is currently working on establishing a plant specific and time specific database of plants. Those records are stored in the Atlanta History Center www.atlantahistorycenter.org.

Invasive Species Control:

Non-native invasive species – both flora and fauna – are an increasing problem throughout all regions of the state. Many of these species pose a serious threat to the local environment and agriculture by overtaking and choking out local species and reducing crop yields. These species may also prove to be a threat to the native and historic flora and fauna. If left unchecked, these invasive species can wreak havoc and alter the natural and historic character of a site and even become credible threats to visitors and staff. Appropriate measures should be taken to control invasive plants and animals.

Departmental Examples:

1. North Carolina Museum of Art, Raleigh, Wake County. The museum has partnered with North Carolina State University’s Department of Forestry to draft an invasive plant species management plan for the entire park. In addition, North Carolina A&T State University in Greensboro will further develop the plan by targeting the eradication

of specific plant species in test plots that will be monitored over a two-year period that began in February of 2006.

Additional Information:

1. See the North Carolina Department of Agriculture and Consumer Services Plant Protection Sections at www.ncagr.com/plantind/plant/weed/weedprog.htm, and Pest Alerts at www.ncagr.com/plantind/plant/entomol/alert.htm, and the Red Imported Fire Ant Program at www.ncagr.com/plantind/plant/entomol/IFA.htm.
2. See the North Carolina Department of Environment and Natural Resources' Water Resources Aquatic Weed Control Program at [www.ncwater.org/Education and Technical Assistance/Aquatic Weed Control/](http://www.ncwater.org/Education_and_Technical_Assistance/Aquatic_Weed_Control/).
3. See the North Carolina Exotic Pest Plant Council at www.se-eppc.org/northcarolina/.
4. See the National Invasive Species Council at www.invasivespeciesinfo.gov/.

NOTES

1. Each of the department's historic sites should develop a Preservation Maintenance Plan (PMP) that is based on a Cultural Landscape Report (CLR) to ensure that the historic integrity of the site is retained. The CLR is a compilation of the history of the property, including any changes to the landscape, and an analysis of the site. This report and the selection of a landscape treatment will form the basis from which the Preservation Maintenance Plan will be created and amended over time. Margaret Coffin and Regina M. Bellavia, "Guide to Developing a Preservation Maintenance Plan for a Historic Landscape", Revised Edition, National Park Service, 1998.

2. "Lawns Public Agency Landscape Management Practices: Waste-Efficient Landscape Maintenance." www.ciwmb.ca.gov/organics/GrassCycling.

3. "Carolina Lawns," North Carolina Cooperative Extension Service, www.turffiles.ncsu.edu/pubs/management/ag69.html, pg. 10.

4. Bilderback and Powell, "Efficient Irrigation," North Carolina Cooperative Extension Service, www.bae.ncsu.edu/programs/extension/publicat/wqwm/ag508_6.html, pg. 1.

5. M. A. (Kim) Powell, "Fertilizing Deciduous Shade Trees in the Landscape," North Carolina State University Horticulture Information Leaflets, Revised 1997, www.ces.ncsu.edu/depts/hort/hil/hil-618.html, pg. 1.

6. A. H. Bruneau, Fred Yelverton, L. T. Lucas, and Rick L. Brandenburg, "Organic Lawn Care: A Guide to Lawn Maintenance and Pest Management for North Carolina," North Carolina Cooperative Extension Service, www.turffiles.ncsu.edu/pubs/management/lawns2.pdf, pg. 10.

7. "Plant Pathology," Master Gardener Ohio State University Extension, www.hcs.ohio-state.edu/mg/manual/path.htm.

ADDITIONAL READINGS

Charles A. Birnbaum, ed., *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes* (Washington D.C.: Historic Landscape Initiative, Heritage Preservation Services, Cultural Resources Stewardship and Partnerships, National Park Service, U. S. Department of the Interior, 1996), 148.

Michael A. Dirr, *Manual of Wood Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses* (Champaign, Illinois: Stipes Publishing L. L. C., 1998), 1250.