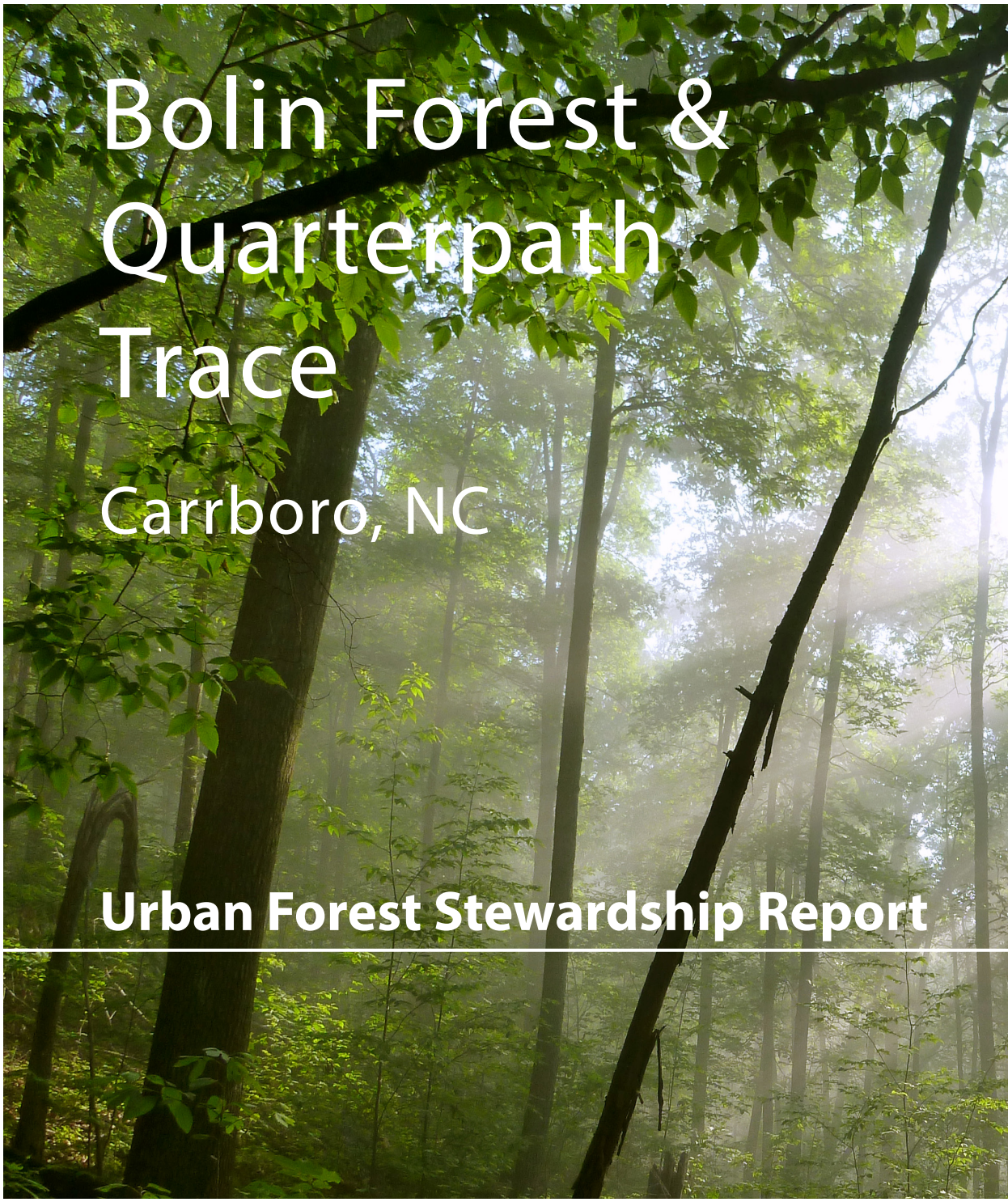


Bolin Forest & Quarterpath Trace

Carrboro, NC

Urban Forest Stewardship Report

Green Roots Environmental Design
Raleigh, North Carolina

AEDAN
WORKSHOP
life elevated

Aedan Workshop
Raleigh, North Carolina

Prepared by:

J. Wesley Aycock IV
James M. Clark

April 2015

Green Roots Environmental Design
109 Ashe Ave Raleigh, NC 27605
www.GreenRootsEnvironmental.com
919.523.1842 | 919.819.2989

Urban Forest Stewardship Report:

Bolin Forest and Quarterpath Trace

Table of Contents:

Executive Summary

Purpose of the Plan

The goal of this report is to provide guidance and direction to the Bolin Forest and Quarterpath Trace communities, educating and empowering a community-driven campaign of stewardship and responsibility for their urban forest.

The Urban Forest

Urban forests are the green spaces that connect city and nature. A healthy urban forest provides many valuable ecological, economic and cultural benefits known as urban natural resources. These benefits include, but are not limited to, clean air, clean water, recreation opportunities, increased property value, increased health and well-being and reduced energy usage.

Components within the urban forest, such as hydrology, vegetation and wildlife habitat, all contribute to these resources and human activities which affect these systems. By better understanding these systems and our impact on them, we can be more conscientious of our actions and act as better stewards for our urban forest.

Urban Forest Stewardship

Urban forest stewardship is the wise use and management of urban forests and urban natural resources to ensure their health and productivity for years to come.[6] Stewarding our urban forests poses challenges and complexities that current strategies struggle to address. As the planet and our communities change, and as research in the field continues, new goals and strategies will need to be developed.

Our Approach

Recognizing the evolving criteria for successful urban forest stewardship efforts, this report presents a broad holistic approach informed by a synthesis of ecological restoration and urban forestry management strategies.

As goals and strategies evolve or become obsolete, what will become most important is not the specific goals and strategies but the spirit with which challenges are approached. We have developed guiding principles that are intended to be a timeless compass for the community as they approach new challenges.

Bolin Forest and Quarterpath Trace

Relatively healthy and mature forest canopy, adjacent large tracts of open land and extensive trail networks all contribute to the value and benefits that the community enjoys. However, conditions including overgrown areas of invasive species, impervious surfaces and even common landscape management practices contribute to negative impacts such as impaired water quality, soil compaction and limited species diversity.

This report highlights current conditions that the community should be aware of, as well as factors that will effect the health of their urban forest in the future. Strengths, weaknesses and threats identified within Bolin Forest highlight opportunities for improvements and inform our recommended strategies and actions.

Strategies and Actions

We have developed strategies and highlighted important actions that Bolin Forest and Quarterpath Trace can begin implementing immediately and use as a point of departure for future planning of stewardship efforts. These strategies approach forest stewardship in a variety of ways to encourage active involvement and collaboration from all members of the community.

Our strategies and actions for Bolin Forest and Quarterpath Trace are organized into four approaches:

Preserve and Restore
Maintain, enhance and expand the benefits of the urban forest.

Plan and Coordinate
Foster coordination between agencies, stakeholders, residents and industry professionals to support stewardship of the urban forest.

Inspire and Educate
Engage the community while increasing understanding of the urban forest and the benefits it provides.

Understand and Adapt
Collect records and information to guide and sustain stewardship of the urban forest.

Appendix: Primary Resources

There are many ways that community residents can help care for the urban forest around their homes. Whether thinking of planting a tree, deciding how to manage Japanese stiltgrass or simply looking for advice from a professional, this set of educational guides provides an excellent starting point to help anyone get involved.

Appendix: Additional Resources

Recognizing that urban forest stewardship is a topic of much discussion and research, this catalogue of local, regional and additional outside resources provides valuable information, educational materials and tools for the community and residents to help steward their urban forest.

I. Purpose of the Plan

The goal of this report is to provide guidance and direction to the Bolin Forest and Quarterpath Trace communities, educating and empowering a community-driven campaign of stewardship and responsibility for their urban forest.

By providing a holistic perspective of forest stewardship and an examination of existing conditions within Bolin Forest and Quarterpath Trace, this report provides homeowners and community groups with the understanding they need to solve problems and adapt to change, extending the reach and effectiveness of this document.

The report is organized into sections which introduce the urban forest, explain challenges of urban forest stewardship, present guiding principles for planning and working through challenges, discuss health indicators of urban forest, highlight strengths and weaknesses of Bolin Forest's urban forest, and provide clear strategies and actionable steps towards improving the community's surrounding urban forest. Additionally, a catalog of documents, websites, and contacts assists with ongoing forest stewardship efforts.

II. The Urban Forest

Urban forests are the green spaces that connect city and nature; they are the streams, wetlands, woodlands, meadows and open spaces that surround our communities.

A healthy urban forest provides many valuable ecological, economic and cultural benefits including:

- Clean air
- Clean water
- Micro and macro climate mitigation
- Wildlife habitat
- Stormwater run-off reduction
- Pollution removal
- Erosion protection
- Recreation opportunities
- Increased property value
- Increased health and well-being
- Reduced energy usage

These benefits and other services provided by the urban forest are referred to collectively as **urban natural resources**. We utilize these urban natural resources for everything from shading our homes in the summer to providing a setting where we can escape from the hustle and bustle of daily urban life.

Understanding the Urban Forest

Geology

Healthy soils are a living system composed of microbes, insects, organic matter and minerals that provide a critical foundation for life. Additionally, healthy soils and the vegetation they support resist erosion, absorb water, slow stormwater run-off and buffer the impacts of fertilizers, chemicals and other pollutants. Soil health is dependent on the rate of soil creation and accumulation, the condition of soil structure and the integral organisms living within it.

Soil Creation and Accumulation

Microbes and other organisms within the soil decompose organic matter, converting it into nutrients and other building blocks of life. Deep-rooted plants help move nutrients from deeper layers within the soil to the surface, making it available to other organisms. Roots help to hold soil in place by stabilizing steep slopes, reducing erosion and allowing additional soil to accumulate.

Often landscape practices do not allow for deep-rooted plants and the natural accumulation of organic material, both in the means of root organic matter and vegetative die-back. Land use, landscape maintenance, and other activities which interrupt the accumulation of organic material, such as routine leaf collection and removal of grass clippings, deplete the available amount of organic material necessary to build soil. Additionally, high-velocity water causes increased erosion and impedes soil accumulation.

Soil Structure

Soil is a media for living organisms. Soil with a structure of interconnected voids allows air and water to reach roots and microbes living within the soil. Good soil structure improves infiltration and the soil's ability to retain water. Lawns, pathways, foot traffic, human activities associated with development and heavy equipment driven on soil all compact the soil and permanently impact its structure.

Hydrology

Clean water provides drinking water, habitat for aquatic life and recreation opportunities. As water moves, it picks up and carries with it many things in its path. Water has the potential to act as a powerful destructive force, sculpting the earth and carrying away valuable topsoil. In contrast, water provides a

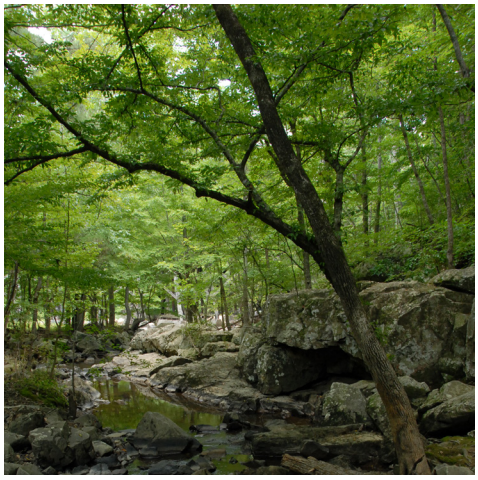
critical foundation for all forms of life, building fertile plains and providing for abundant aquatic ecosystems.

Our water resources consist of both surface water in the form of streams, wetlands and lakes, as well as groundwater, slowly moving through soil and underground aquifers. Groundwater is a reliable and essential source of water, especially during droughts. This resource sustains the base flow in our streams, irrigates our crops and supplies our homes with water.

The quality and availability of both surface and groundwater are influenced by pollution, as well as the velocity at which water travels as it moves through the urban forest.

Pollutants

Actions ranging from improper pet waste disposal and lawn and auto maintenance, to small-scale construction can contribute to pollutant levels in run-off that impact water quality. Algal blooms, stemming from excess nitrogen found in water, deplete oxygen available within water, diminishing the conditions which support aquatic life. Chemical run-off from leaking automotives, improper waste disposal and over-applied fertilizers or pesticides can degrade aquatic ecosystems, resulting in fish kills, contaminated drinking water or loss of recreational use. Excessive landscape debris and other organic matter can collect and decay in waterways, consuming oxygen in the process and killing aquatic life.



Rate of Water Movement

Conventional stormwater conveyances, impervious surfaces such as roof tops and driveways and compacted soils found in lawns and pathways all result in an increase in the volume and velocity of stormwater runoff. This contributes to the stormwater's ability to cut and scour soil, causing erosion throughout the watershed and degradation of the stream corridor itself. Additionally, increased velocity contributes to the ability of water to carry pollutants.

Fast-moving water is less capable of soaking into the soil and recharging aquifers which feed wells and provide clean water. Additionally, water flowing over impervious surfaces and through pipes is unable to support life and take part in the natural processes which clean and filter water. As stormwater moves quickly across these impervious surfaces and through conventional stormwater systems of curbs and pipes, it arrives at streams with greater velocity and volume, causing washouts, flash floods, and destruction to both natural and human environments as it moves downstream.

Healthy streams naturally flood their banks, allowing for a reduction in speed and destructive ability of water while also unloading sediments and nutrients which build fertile soil and reduce pollutant levels within the stream. Incised streams, where water is unable to access its natural flood plain, contribute to high volume and velocity stormwater runoff, as well as increased sediment and nutrient loads within the water.

Vegetation

Plants are one of nature's most impressive residents, converting water, sunshine and bare earth into life while stabilizing and creating soil, producing oxygen and providing food and shelter for an abundance of living organisms. Vegetation provides habitat, shade, clean air, recreational opportunities, climate mitigation and carbon sequestration. Additionally, vegetation can provide aesthetic value and increased property value.

Any given plant community falls somewhere along the successional phase from primary successional communities, such as grasslands and meadows supporting new growth that faces frequent disturbance, to climax communities, such as old growth forests that show little disturbance.

Plant Composition

The composition of plants, meaning the individual species, the variety of species and the variety of the relationships between the species, is the primary variable in determining the character and productivity of an ecosystem. Humans are affecting this in many ways, some as simple as creating more edge and disturbance areas, which in turn favor pioneer and generalist species. These adaptable species are often considered invasive or nuisance species.

Soil and plant composition is influenced by environmental factors such as climate, plant competition, wildlife browsing, human development, climate change and disturbances including storms. In some cases, the environmental conditions or frequency of disturbance in an area will result in a plant community which remains in one of the initial stages of succession rather than progressing as usual. Succession and disturbance are common occurrences in natural systems and often represent desirable change. Even seemingly stable communities are dynamic, in a state of constant change, and influenced by disturbance.

Healthy urban forests are composed of diverse plant communities and are more resilient and able to adapt to change. The major way in which humans impact plant composition is through interference with the natural process of succession and regeneration.

Invasive Species

Certain species are well adapted to specific successional phases. Many invasive species, for example, are adapted to frequent disturbances, making them well-adapted to capitalize on the forest environments adjacent to humans, as human development perpetuates the conditions on which these species thrive.

Wildlife and Habitat

Quality wildlife and habitat composition contribute to the urban forest ecosystem by increasing biodiversity, building soil and preserving balance of natural competition. Additionally, wildlife provides recreation opportunities and a valuable connection with nature.

Wildlife depends upon clean water, soil and vegetation collectively to provide suitable habitat.

Wildlife provides seed dispersal for plants, helps to balance populations of insect or nuisance species as well as many other ecological tasks which help sustain the urban forest and our enjoyment of its resources.

Basic Needs

Basic needs of all wildlife are food, water, shelter and space. Wildlife requires cover from the elements for nesting and protection from predators. A diversity of habitat is critical to support diverse wildlife; fallen logs of various sizes, stumps, cut tree tops and brush piles can also provide cover for wildlife. Nuts, acorns, seeds and fruit provide food as well as foliage. Riparian zones, streams and rivers, forested wetlands and springs provide water.

The structure of the forest itself provides space for wildlife and can help determine what species will thrive in specific areas. Some species require large expanses of uninterrupted forest while others adapt well to the fragmented habitats often found in urban areas. Additionally, some species specialize in a specific habitat type or successional phase, such as meadows or under-story shrubs, while others utilize and require a mixture of habitat types. In general, the species best adapted to urban environments are those that can thrive in many different habitat types.

Developments such as Bolin Forest have fragmented large forests, making animals that require larger contiguous blocks of forest less prevalent. Constantly changing pressures from humans, development, invasive species and imbalances in competition can lead to broad and far-reaching changes in the quality, abundance and resilience of habitat and wildlife composition. The primary causes of decline in the health of wildlife species include habitat loss and fragmentation, introduced species and disease, overpopulation of certain species, pollution and poor management practices.

Edge and fringe habitats created by human development are preferred by certain species, making these species more prevalent and sometimes a nuisance.

Culture, Recreation and Community Amenities

A community and its residents can gain valuable economic, social, physical, mental and emotional benefit by stewarding their urban forest. People living near open space and natural amenities are generally happier. Community amenities and outdoor spaces help build a stronger sense of community. Urban forests also provide unique health benefits, encourage an active lifestyle and foster activities that have less environmental impact.

Fire Threat and Safety

Homes within the urban forest are inherently close to fuel sources and fire can spread quickly, posing threat to life and property. In addition, risks from falling trees and limbs, hazardous wildlife and even poor sight-lines from overgrown vegetation may pose threats to residents of the community.

"We've forever altered the Earth, and so now we cannot abandon it to a random fate. It is our duty to manage it. Luckily, it can be a pleasant, even joyful task if we embrace it in the right spirit." [4]

III. Urban Forest Stewardship

As urban areas continue to expand and human populations grow, healthy urban forests become increasingly at risk to the pressures of development and human activities. Urban forests and the urban natural resources they provide will become more essential to sustaining human well-being and the vitality of our communities.

We have the unique responsibility to steward these forests and keep them healthy and thriving if we are to continue enjoying their benefits.

Urban forest stewardship is the wise use and management of urban forests and urban natural resources to ensure their health and productivity for years to come. [6]

"The care and management of many urban forests can be complicated by natural and social factors including: insects and diseases; wildfire; natural catastrophic events (such as ice storms and wind storms, including hurricanes); invasive plants; climate change; development; air pollution; lack of adequate management; and other social factors. As urban expansion continues, such challenges are likely to increase and new ones might emerge." [5]

Successful urban forest stewardship necessitates an educated and empowered community effort. While a thorough knowledge of forest ecology is not required, basic awareness of the complex natural systems surrounding our communities is valuable in helping to sustain a healthy urban forest. Simple ways to increase this awareness are getting out and enjoying the spaces we aim to protect or helping organize events to get others involved.

An Evolving Approach

Defining goals and criteria for the assessment of success in urban forest stewardship has been the topic of scholarly and professional dialogue.

Urban Forestry Management

Traditionally, urban forestry management has focused on overall forest canopy cover for the evaluation of success. While the application of this approach benefits from its simplicity, forest canopy coverage alone is not representative of the full breadth

and depth of urban forest functions and their health. In a 2011 article, Kenney et al. helped progress forest health evaluation by presenting updated criteria for more comprehensive analysis.[1] While Kenney's new criteria advanced beyond traditional approaches, even the new criteria and indicators he proposed do not address urban forests as natural systems. Identifying these shortcomings, we have turned to the field of ecological restoration for a broader ecosystem scale perspective.

Ecological Restoration

Ecological restoration is engaged in renewing and restoring ecosystems for the benefit of overall ecological value. Traditionally, ecological restoration efforts have utilized the ideal of pristine pre-Columbus wilderness as a baseline to inform and assess their work. However, increasing awareness of the realities of an ever-changing planet and global human impact has initiated discussion of the merit and validity of relying exclusively on these historical baselines.

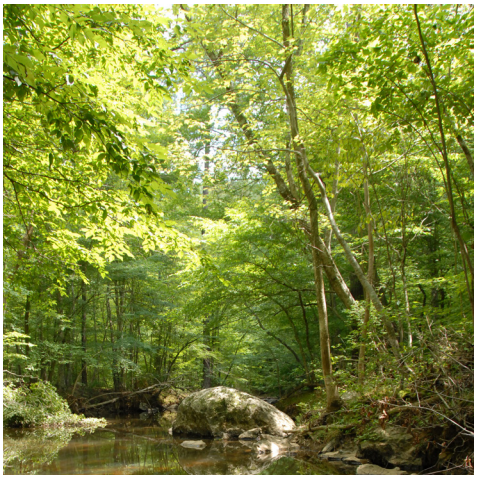
A Need for a New Perspective

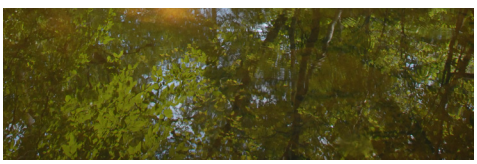
Given the complex considerations to define criteria for even our most pristine wilderness, how can one identify a single definitive set of goals for a place as dynamic as a city, town, or community such as Bolin Forest?

There is a need for a broad holistic approach synthesizing consideration for our economic, social and cultural vitality with an understanding of our dependence on complex ecosystems and biological processes, to create an adaptable platform which can evolve with changing realities and our needs.

Additionally, planning from this approach needs to be accessible and usable by both industry professionals and community members to be successful.

"It's easy to think of forests as peaceful, unchanging places. In reality, this isn't the case, because forests are much more dynamic than they may seem. In fact, forests are shaped by change, and many forest ecosystems depend upon it." [2]





"For every piece of land, its owners, its managers, governments and other people who care about it will have to come together" to address each new challenge, adapting and learning along the way. There is no one set of goals or strategies that will work in all situations." [4]

IV. Our Approach

Recognizing the evolving criteria for successful urban forest stewardship efforts, this report presents a broad holistic approach informed by a synthesis of ecological restoration and urban forestry management strategies.

Goals should be developed and assigned by an ongoing effort of community conversation. Actions and strategies should be approachable and attainable by anyone looking for ways to participate.

However, as research continues, communities change and the planet changes, new goals and strategies will need to be developed as old goals become obsolete.

What is most important, however, is not specific goals, strategies and actions, but the spirit with which you approach challenges. We have developed a set of guiding principles that are intended to be a timeless compass to guide the community as they approach new challenges.

V. Guiding Principles

The following guiding principles should help to lead community decision making, prioritize goals and inform actions to implement responsible and holistic management strategies:

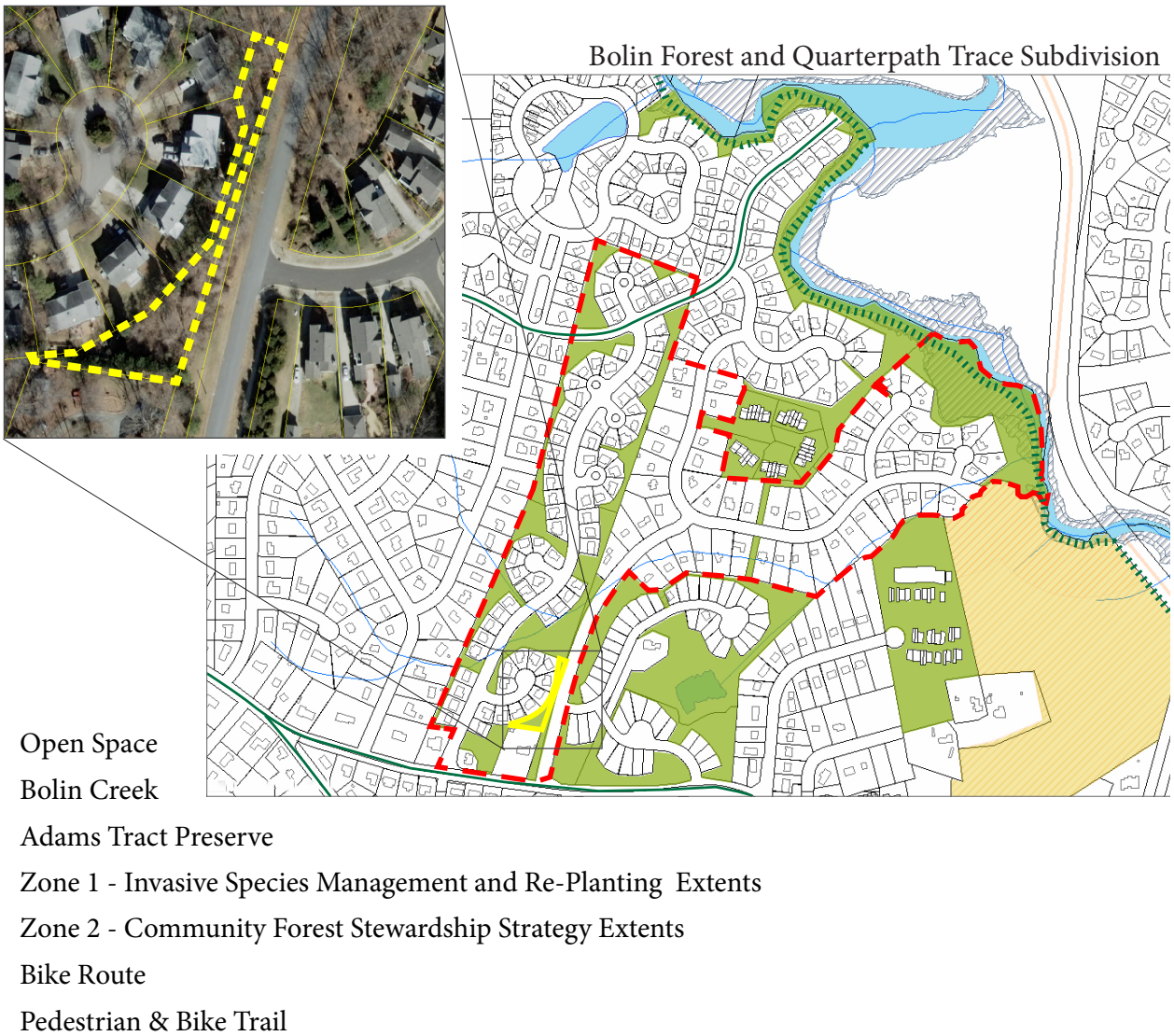
- Recognize our relationship to other living beings and our mutual dependence on the resources provided by the web of natural systems of which we are all a part.
- Understand that living things collaborate to create the conditions on which life depends.
- Protect life and the quality of life. Communities are first and foremost for people and the primary objective of urban forest stewardship is to improve the quality of life of its residents.
- Conserve resources, reduce waste, opt for biological and renewable resources and methods. Use chemicals and other non-renewables as a means to an end rather than as an end unto itself.
- Embrace synergy and the power of collaboration. In nature, each element performs multiple functions; each function is supported by multiple elements. Apply this wisdom.
- Change is constant. Realize this as an opportunity for creativity, flexibility, growth and learning.
- Don't be afraid to make a mistake. Be willing to experiment, learn and try again.

VI. Bolin Forest & Quarterpath Trace

Our assessment of forest health and productivity is based on a holistic examination of the urban natural resources presented within the community and an evaluation of their benefits and impacts to the community.

Overview

The Bolin Forest and Quarterpath Trace communities fall within the Bolin Creek, Horace Williams B watershed, and border 11,000 linear feet of Bolin Creek along their northeast property boundary. All stormwater and run-off from the communities are conveyed into Bolin Creek by a system of stormwater devices and a tributary stream, Dry Gulch Creek, entering Bolin Creek to the east of Bolin Forest Dr. Precipitation and runoff eventually makes its way to Jordan Lake reservoir where it provides drinking water for nearly 250,000 citizens in Cary, Apex, Morrisville, Chatham County, and the Research Triangle Park.



Bolin Forest and Quarterpath Trace are comprised predominantly of upland dry mesic oak-hickory forest and lowland mixed mesic hardwood forest (Piedmont subtype).

The community is part of the wildland urban interface, where extensive North Carolina Piedmont forest intersects with urban development. Open spaces within the community comprised of suburban landscapes, easements, and right-of-ways are part of a larger forest matrix which extends beyond property boundaries and join with neighboring undeveloped land of Adams tract to the east and Carolina North to the north. Wildlife inhabiting Bolin Forest includes most birds, mammals, amphibians and insects common to Piedmont mixed hardwood forests. One of only nine locations within Orange County, Bolin Creek provides home for the four toed salamander, a North Carolina species of special concern.[7]

The following strengths, weaknesses and threats are based upon on-site observations and analysis, GIS studies and previous research and findings performed by Orange County and the town of Carrboro.

Strengths

In large part, the undeveloped open spaces within the greater Bolin Forest community have soil conditions that are native to the geology and ecology of the region and are therefore considered to be relatively healthy.

Forest canopy, a non-curb-and-gutter system, stormwater retention areas, stream buffers and individual homeowner efforts to help slow down, capture, and clean stormwater runoff before entering Bolin Creek help to mitigate the negative impacts of the greater Bolin Forest community on its local watershed.

An area of mesic mixed hardwood forest remains relatively undisturbed along the Bolin Creek corridor and is regarded as a natural heritage site of county level significance by the North Carolina Natural Heritage Program.[7]

Mature old growth tree specimens found throughout the site, such as oaks and hickories combined with sub canopy and shrub layer vegetation, provide wildlife habitat for songbirds, squirrels, and many other native fauna.

Ideal breeding ground for migrant birds such as the Cedar Waxwing and habitat for bluebirds, woodpeckers, and red-shouldered hawks, along with many other species, occurs within the Bolin Creek corridor.

Dead trees that remain standing are referred to as snags and occur throughout the community, providing shelter and food sources for many types of wildlife from worms to woodpeckers.

A community garden located within The Cedars provides neighbors with the opportunity to grow their own fruits and vegetables.

There is active community involvement with significant volunteer participation.

Accessible trails passing through healthy woodland forest provide excellent connection to the urban forest. A railway trestle, as well as an antique car filled with stones found along the trails, adds unique character and sense of place.

Open spaces, trails, playgrounds, and community gardens provide excellent places for recreational opportunities such as jogging, hiking, biking, bird watching, gardening or simple relaxation.

Comprehensive networks of greenways, pathways, sidewalks, bike trails, and bus routes decrease dependency on automobiles and increase physical activity and social interaction within the community.

The forested areas along the Bolin Creek corridor, including Carolina North and Adams Tract, are well known as some of the best walking areas within the Chapel Hill area.

Weaknesses:

Pollutants from pet activity and improper waste disposal, leaking and improper disposal of household chemicals, detergents and automotive fluids within the floodplain of Bolin Creek threaten water quality and contribute to Bolin Creek's 303(d) water impairment status.

Conventional landscape management techniques such as the use and over-application of herbicides, fertilizers and fungicides threaten water quality and aquatic habitat by adding nutrient and chemical loads to streams.

Common Sources of Water Pollutants:

Nutrients: Fertilizer, animal waste, improperly maintained septic systems
Toxins: Pesticides, herbicides, fungicides, automotive and household chemicals, leaks and improper disposal of household chemicals
Sediment: Construction, unstable soils
Organic Materials: Yard waste (grass clippings, leaves, etc.)

Increased volume and velocity of stormwater runoff have created or contributed to incised banks along Bolin Creek and smaller feeder streams.

Piped and linear stormwater conveyances occurring on a residential and neighborhood scale contribute to higher velocity of stormwater runoff. Additionally, impervious and compacted surfaces in the form of lawns, patios, paths, roads and driveways increase the volume stormwater runoff.

Compacted and degraded soils within the Bolin Creek corridor are of special concern.

Many areas within the greater Bolin Forest community have been subject to compaction both during construction and from current activities.

Valuable plant species in general are limited, especially in landscapes and easements. Areas with minimal plant species age distribution and regeneration were also observed.

Invasive species such as Japanese stilt grass, wisteria, mimosa, privet, greater and minor periwinkle, wild olive, tree of heaven and English ivy are prevalent throughout the community along easements, roadways, streams as well as individual properties. Japanese stilt grass is especially prevalent in low-lying and flood-prone areas.

In general, residential properties consist of primarily non-native plants and do not provide optimal habitat and food sources.

Dead or damaged trees pose threats near homes and trails.

While forest fire within the region is rare, development within the wildland urban interface, such as Bolin Forest, is inherently close to fuel, posing the potential threat of fire damage.[3]

Threats:

Activities such as construction of new trails or impervious surfaces have the potential to cause significant erosion and sediment run-off, especially around highly erosion-prone soils with localized areas of steep slope and shallow soils located along Bolin Creek.

Lack of forest regeneration, invasive species and over-abundance of deer can alter composition of the forest, affecting its health and the benefits and resources it provides.

Areas left to become overgrown with invasive species may produce changes in composition of the forest and therefore threaten habitat for desirable native wildlife.

As forests age, debris can accumulate and increase the risk for wildfire.

Unmaintained water quality BMPs and septic tanks can pose threat of ongoing degradation of water quality as well as increased maintenance and repair costs.

Impervious surfaces and increased stormwater runoff reduce groundwater movement into aquifers and threaten our access to water.

Over time, aging and unmaintained trees may become more susceptible to damage and increase maintenance costs or repairs from fallen limbs or trees.

VII. Strategies and Actions

Urban forest management requires critical thinking, problem solving, adaptability, creativity and keen observation, with active involvement and collaboration between all parties. These specific strategies and actions have been developed for the Bolin Forest and Quarterpath Trace communities to highlight current opportunities for improving the urban forest. These strategies and actions should serve as a point of departure for current and ongoing stewardship efforts.

Strategies and actions are organized into four approaches:

Preserve and Restore

Maintain, enhance and expand the benefits of the urban forest.

Plan and Coordinate

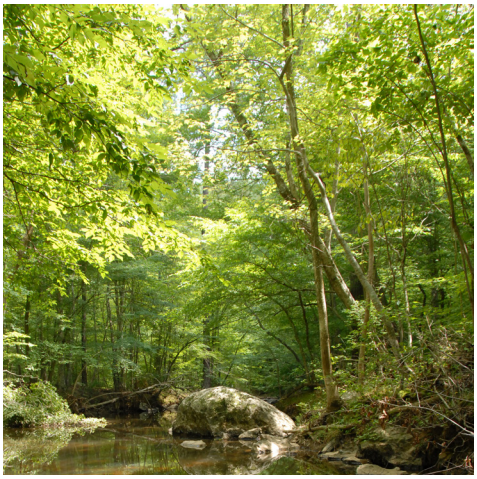
Foster coordination between agencies, stakeholders, residents and industry professionals to support stewardship of the urban forest.

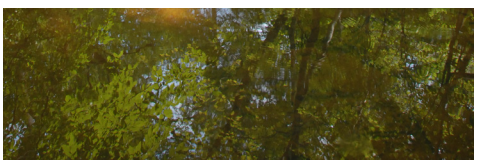
Inspire and Educate

Engage the community while increasing understanding of the urban forest and the benefits it provides.

Understand and Adapt

Collect records and information to guide and sustain stewardship of the urban forest.





Preserve And Restore

Maintain, enhance and expand the benefits of the urban forest.

Achieve a goal of 40% tree canopy cover.

Start Here.

Implement stiltgrass fall mowing procedures.

Collect and slow rainwater.

Stabilize areas of erosion.

Minimize impervious surfaces.

Reduce lawn areas.

Always collect and dispose of pet waste.

Relocate or remove flammable materials and debris located in proximity to structures.

Identify and remove trees and limbs that pose a threat to life or property.

Water Quality

Plant and stabilize stream banks.

Minimize footpaths within stream corridors.

Prevent pet waste and debris from entering streams and stormwater systems.

Construct rain gardens and dry-streams.

Utilize cisterns and rain barrels to harvest rainwater.

Improve and maintain existing community stormwater system.

Ensure that contractors utilize industry standard tree protection methods.

Planting

Avoid invasive species in all planting activities.

Choose native plants when appropriate.

Select plants with multiple benefits such as high wildlife value or edibility.

Select drought tolerant plants and turf species when appropriate.

Implement appropriate measures to protect vegetation from deer as needed.

Choose organic, chemical-free and biodegradable alternatives for everything from lawn care to car-washing.

Safety

Selectively trim, thin, or remove vegetation to preserve sight lines and defensible spaces around structures, trails and roads.

Monitor and dampen debris such as compost or firewood piles as appropriate during periods of high fire hazard.

Select fire resistant plants where appropriate.

Construct and Improve:

Trails
Community Gardens
Community Compost Area
Playgrounds
Pavilions
Benches
Sport courts
Bird houses and feeders
Pet waste receptacles

Plan And Coordinate

Foster coordination between agencies, stakeholders, residents and industry professionals to support stewardship of the urban forest.

Start Here.

Form a Community Forest Stewardship Committee.

Budget for common space and community stormwater system maintenance, street tree planting and other urban forest stewardship efforts.

Consider a tree preservation ordinance.

Encourage government policies and practices that support urban forest stewardship.

Create a calendar of events

that include monitoring and maintenance routines, community workdays and community gatherings.

Adopt environmental best management practices.

Partnerships

Offer volunteer opportunities to local groups and individuals such as scouts and local students.

Engage local organizations such as universities and non-profits for resources such as funding, material, volunteers and expertise.

Forest Stewardship Committee

Organize volunteer workdays, educational events, celebrations and other initiatives.

Coordinate and delegate resources including funding, materials and volunteer efforts.

Plan fundraising events and other creative funding opportunities.

Field input and requests from community and function as a resource to the community.

Set an agenda and prioritize actions.

Implement a process to respond and adapt as new information from routine reports and outside sources becomes available.

Consider HOA fee structure for Urban Forest Stewardship efforts.

Circulate informational bulletins and reminders during times of drought or when specific seasonal maintenance is needed.

Encourage Local Government to:

Identify urban forests and urban natural resource preservation and management as a priority.

Provide guidance, incentives and funding to facilitate forest stewardship.

Adopt management practices such as fall Japanese stiltgrass mowing to encourage healthy forests.

Develop an Urban Forest Stewardship Plan.

Consider economic advantage of a green infrastructure approach when allocating resources to tree maintenance and other urban forest stewardship activities.

Develop a policy and management strategy to address deer populations.

Inspire And Educate

Engage the community while increasing understanding of the urban forest and the benefits it provides.

Start Here.

Host community functions.

Recognize a Steward of the Month.

Lead educational workdays and presentations.

Use signs to highlight ongoing initiatives within the community.

Celebrate positive contributions through a system of recognition.

Implement signage explaining natural features and systems within the urban forest such as keystone species, stream floodplains and forest regeneration.

Sponsor garden tours, hikes, cookouts and other activities which build community support and involvement.

Provide opportunities for residents to plant trees on community property to commemorate significant life events.

Continue efforts to communicate information from the Urban Forest Stewardship Report to the community in consolidated and usable formats.

Pursue inclusive engagement, providing a variety of opportunities for both stewarding and enjoying the urban forest.

Understand And Adapt

Collect records and information to guide and sustain stewardship of the urban forest.

Start Here.

Conduct a tree canopy coverage assessment.

Perform routine monitoring for threats to forest health and human safety.

Document milestones and achievements.

Log volunteer hours.
Log trees planted.
Log funding contributions and expenses.

Prepare routine reports.

Monitor for safety hazards, invasive species, areas of erosion, debris accumulation, pollution, unhealthy trees, and threats to water.

Utilize partnerships to document quantifiable indicators of forest condition, establish baselines, and perform ongoing studies.

Ensure that all findings and reports are promptly communicated to the Forest Stewardship Committee.

References:

1. Kenney WA, van Wassenaer PJE, Satel AL. Criteria and Indicators for Strategic Urban Forest Planning and Management. Arboriculture & Urban Forestry 2011 [cited 2015 Jan]. Available from http://www.www2.champain.isa-arbor.com/events/conference/proceedings/2013/VAN_WASSENAER_article_AUF_%20May_2011.pdf

2. Ketcham C. Young Forests Can Benefit Wildlife [Internet]. Asheville (NC): United States Department of Agriculture Forest Service (US); 2014 June [cited 2015 January]. Available from http://www.fs.usda.gov/detail/nfsnc/home/?cid=STELPRD3802497

3. Long AJ, Randall CK. Wilfire Risk Assesment for Homeowners in the Southeastern United States [Internet]. Gainsville (FL): University of Florida; 2014 July [cited 2015 January]. Available from http://www.interfacesouth.org/products/publications/wildfire-risk-assessment-guide-for-homeowners-in-the-southern-united-states/index_html

4. Marris, Emma. Rambunctious Garden: Saving Nature in a Post-Wild World. New York (NY): Bloomsbury; 2011. 210 p.

5. Nowak JD, Stein SM, Randler PB, Greenvield EJ, Comas SJ, Carr MA, Alig RJ. Sustaining America's Urban Trees and Forests. United States Departement of Agriculture Forest Service. 2010 June. [cited 2015 Jan]. Available from http://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf

6. O'Donnell EM, Chunko SE, Finley JC, revised by Muth A. Forest Stewardship Our Link to the Past - Our Legacy for Future [Internet]. Pennsylvania State University; 2008 [cited 2015 July]. Available from http://www.forestmanagers.com/ForestStew1.pdf

7. Sorrie B and Shaw R. Inventory of Natural Areas and Wildlife Habitats for Orange County, North Carolina [Internet]. HIllsborough (NC): Orange County Environment and Natural Resource Conservation Department; 2004 December [cited 2015 January]. Available from http://www.orangecountync.gov/ercd/documents/Natural%20Area%20Inventory%202004.pdf

Appendix 1: Primary Resources

To assist with future projects and ongoing maintenance, the following guides and handouts provide useful information for homeowners and HOA leaders to help steward the community's urban forest. The guides below include information about the following:

- Selecting Desirable Tree Species
- How to Plant a Tree or Shrub
- Ongoing Care and Maintenance
- Identifying and Managing Japanese Stiltgrass
- How to Consult a Professional

Plant A Tree

Selecting Desirable Species

Planting a tree creates a lasting legacy, often spanning multiple generations. It is a rewarding project but is not without its challenges. Plant characteristics, maintenance requirements and site conditions all affect the health and vitality of a plant as well as costs of maintenance in the long term. Plant selection is an important decision that warrants careful consideration and planning. Before investing valuable time and resources into planting, it is best to consult a knowledgeable and experienced professional.

Right Plant, Right Place

Give consideration to existing site constraints such as environmental conditions, human uses and wildlife habitats to help determine suitable plant selection and location. You should also consider the potential benefits and impact to surroundings.

In many cases, compromises are made, giving priority to the most desirable characteristics and most critical requirements. Most plants only thrive within a narrow range of conditions and only exhibit some of the desired characteristics. The following are characteristics and requirements to consider when selecting a plant.

Plant Cultural Requirements:

- Sunlight
- Moisture
- Soil drainage
- Soil acidity
- Soil fertility
- Hardiness

Other Plant Considerations:

- Mature size
- Growth rate
- Lifespan
- Privacy
- Passive solar benefit (Shade)
- Protection from wind
- Resistance to pest and disease
- Resistance to pollution
- Resistance to ice and wind damage
- Deer resistance
- Aesthetics
- Native status
- Wildlife value
- Space constraints
- Up-front costs
- Long term costs
- Leaf and limb debris
- Protection of property
- Safety
- Fruit production

The following lists provide a starting point for selecting native species for various conditions. Additional factors should be considered to ensure the selection will flourish in a specific setting.

Small Trees

Painted Buckeye - *Aesculus sylvatica*
Serviceberry - *Amelanchier arborea*
American Hornbeam - *Carpinus caroliniana*
Redbud - *Cercis canadensis*
Fringetree - *Chionanthus virginicus*
Flowering Dogwood - *Cornus florida*
Winterberry Holly - *Ilex decidua*
American Holly - *Ilex opaca*
Yaupon Holly - *Ilex vomitoria*
Sweetbay - *Magnolia virginiana*
Wax Myrtle - *Myrica cerifera*

Evergreen Trees

Ti-ti - *Cyrilla racemiflora*
American Holly - *Ilex opaca*
Yaupon Holly - *Ilex vomitoria*
Eastern Red Cedar - *Juniperus virginiana*
Southern Magnolia - *Magnolia grandiflora*
Wax Myrtle - *Myrica cerifera*
Wild Olive - *Osmanthus americanus*
Live Oak - *Quercus virginiana*

Trees Beneficial to Wildlife

Painted Buckeye - *Aesculus sylvatica*
Serviceberry - *Amelanchier arborea*
American Hornbeam - *Carpinus caroliniana*
Persimmon - *Diospyros virginiana*
Yaupon Holly - *Ilex vomitoria*
American Holly - *Ilex opaca*
Possumhaw - *Ilex decidua*
Eastern Red Cedar - *Juniperus virginiana*
Wax Myrtle - *Myrica cerifera*
Carolina Cherrylaurel - *Prunus caroliniana*
Black Cherry - *Prunus serotina*
Live Oak - *Quercus virginiana*

Trees for Dry Soil

Redbud - *Cercis canadensis*
Fringetree - *Chionanthus virginicus*
Green Ash - *Fraxinus pennsylvanica*
Yaupon Holly - *Ilex vomitoria*
Eastern Red Cedar - *Juniperus virginiana*
Sourwood - *Oxydendrum arboreum*
Winged Sumac - *Rhus copallinum*

Trees for Moist Soil

Serviceberry - *Amelanchier arborea*
River Birch - *Betula nigra*
American Hornbeam - *Carpinus caroliniana*
Possumhaw - *Ilex decidua*
Ti-ti - *Cyrilla racemiflora*
Southern Magnolia - *Magnolia grandiflora*
Sweetbay - *Magnolia virginiana*
Black-gum - *Nyssa sylvatica*
Eastern Hornbeam - *Ostraya virginiana*
American Sycamore - *Platanus Occidentalis*
Overcup Oak - *Quercus lyrata*
Willow Oak - *Quercus phellos*
Bald Cypress - *Taxodium distichum*

Plant A Tree

Balled and Burlapped - Planting and Care

Balled and burlapped specimens are grown in a field and excavated upon order. They are often the largest plants available, but can lose up to 75% of their roots when dug. They require multiple seasons to establish new roots before vegetative growth emerges. The labor and time associated with this type of plant increases the cost.

Planting

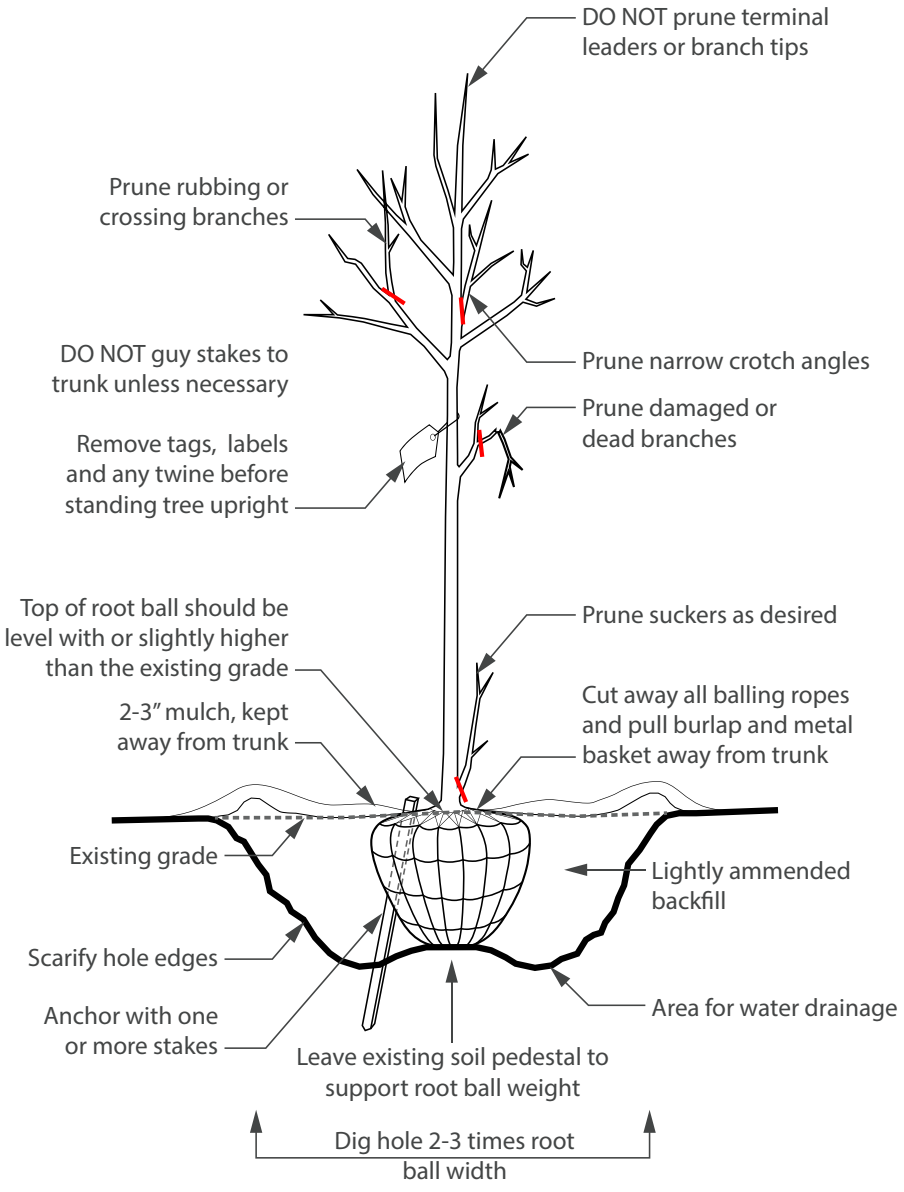
1. Mark and excavate a hole two to three times the diameter of the root ball. The depth of the hole should be equal to the height of the root ball.

2. Cut and unwrap any tags or twine wrapping the branches, as these may be hard to reach once the plant is placed in the hole.

3. Place the root ball into the hole verifying the depth is correct and that the plant is standing straight from all directions.

4. Lightly amend the excavated soil by mixing in aged pine bark fines or soil conditioner. Backfill the hole halfway with amended native soil and compact lightly to hold the plant in place.

5. Cut and remove any twine that is holding the top of the metal basket together. Pull back the burlap exposing the trunk of the tree and cut away all excess material.



6. Verify that the plant is still standing straight and continue backfilling soil to the top of the root ball. Tamp soil lightly to ensure good soil contact with the root ball and to prevent settling around the plant.

7. Create a water-holding ring around the base of the plant by mounding soil 1-2” tall at about the diameter of the root ball. Spread 2-3” of mulch over any exposed soil preserving a 2” diameter open area around the trunk of the plant.

8. Prune damaged or dead branches as necessary.

9. Provide slow and deep watering to help eliminate air pockets and ensure even moisture.

10. Continue to water, monitor and fertilize as described below.

Ongoing Care

Watering needs for a balled and burlapped plant are unique since most of its water-absorbent, fibrous roots have been lost during transplanting. Soil should be monitored and kept moist throughout the first growing season and given additional attention during periods of dry and hot weather. Extended periods of monitoring and watering may be necessary for larger plants.

Monitor New Plants

Determining when to water a new plant requires checking for soil moisture and assessing plant appearance on a weekly basis. Assess the overall condition of the plant and look for signs of stress such as wilting, dry, or yellowing leaves. Determine whether the surrounding soil is too dry, adequately moist, or too wet by digging down 2-3” and feeling for soil moisture. Keep a schedule of monitoring and track watering frequency and amount.

Encourage Deep Roots

Slow and deep watering is necessary to ensure even and adequate moisture is delivered to all roots and soil surrounding the plant. Over time, the frequency of monitoring and watering should decrease, but the duration of watering should increase. This process provides moisture when root systems are still tender and encourages deeper root growth as the plant begins to establish itself. The end result is deep-rooted plants that only require watering on an as-needed basis.

Protect from Frost

Young plants with unestablished shallow root systems are more susceptible to frost damage during the winter. Water plants and ensure even soil moisture prior to hard frosts to help protect plants from frost and root damage.

Plant A Tree

Container - Planting and Care

Container-grown specimens begin in a small pot and are replanted into larger containers as they grow. They have a complete and fibrous root system, allowing them to establish quickly and begin vegetative growth immediately.

Planting

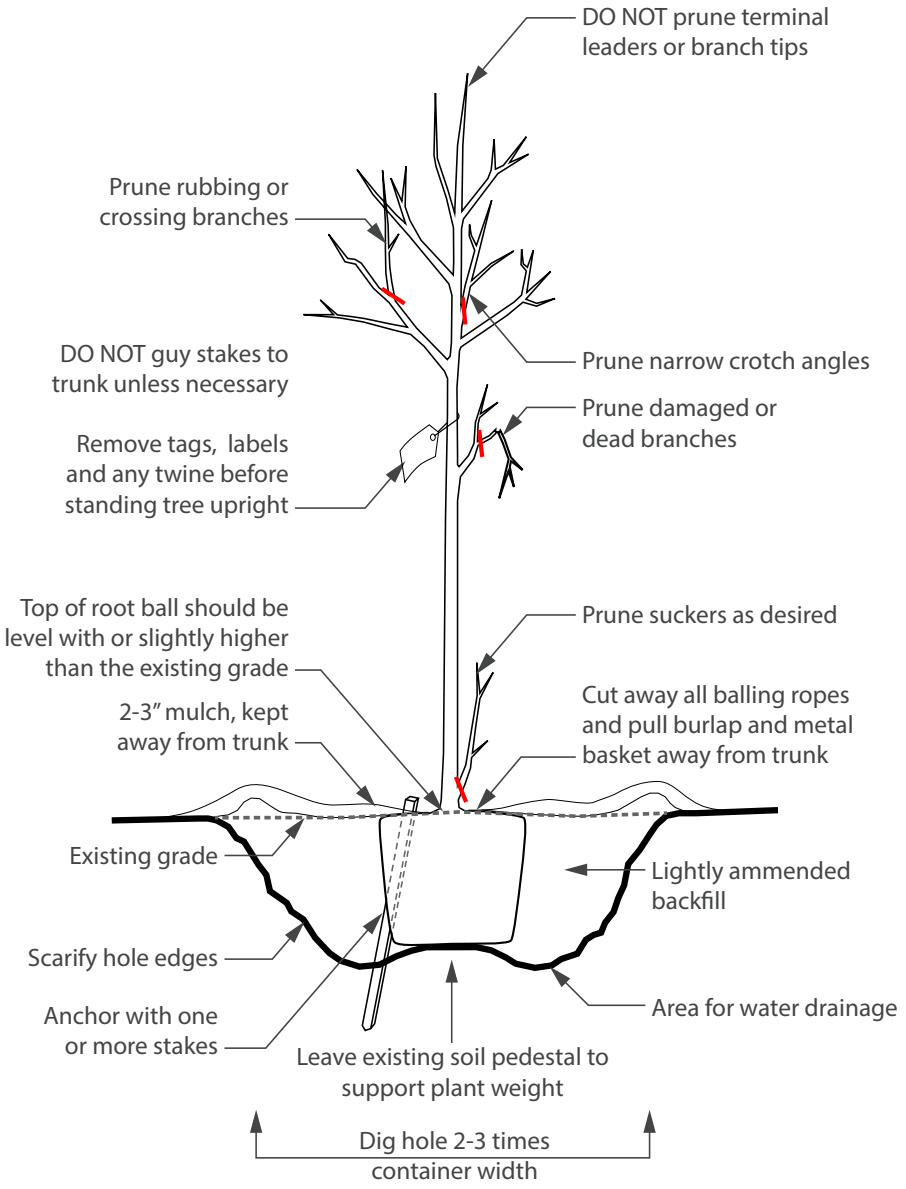
1. Mark and excavate a hole two to three times the diameter of the plant container. The depth of the hole should be equal to the distance from the bottom of the container to the base of the trunk.

2. Lightly amend the excavated soil by mixing in aged pine bark fines or soil conditioner.

3. Cut and unwrap any tags or twine wrapping the branches, as these may be hard to reach once the plant is placed in the hole.

4. Remove the plant from the container and loosen the surface of the roots to release any girdling or spiraling roots. This will prevent the plant from becoming root bound and encourages healthy outward growth of the root system.

5. Place the plant into the hole verifying the depth is correct and that it is standing straight from all directions.



6. Backfill the hole halfway with amended native soil and tamp lightly to hold the plant in place. Verify that the plant is still standing straight and continue backfilling soil to the top of the root collar. Tamp soil lightly to ensure good soil contact with the roots and to prevent settling around the plant.

7. Create a water holding ring around the base of the plant by mounding soil 1-2” tall at about the diameter of the root ball. Spread 2-3” of mulch over the exposed soil except for a small 2” diameter around the trunk of the plant.

8. Prune damaged or dead branches as necessary.

9. Provide slow and deep watering to help eliminate air pockets and ensure even moisture.

10. Continue to water, monitor and fertilize as described below.

Ongoing Care

Soil should be monitored and kept moist throughout the first growing season and given additional attention during periods of dry and hot weather. Extended periods of monitoring and watering may be necessary for larger container plants.

Monitor New Plants

Determining when to water a new plant requires checking for soil moisture and assessing plant appearance on a weekly basis. Assess the overall condition of the plant and look for signs of stress such as wilting, dry, or yellowing leaves. Determine whether the surrounding soil is too dry, adequately moist, or too wet by digging down 2-3” and feeling for soil moisture. Keep a schedule of monitoring and track watering frequency and amount.

Encourage Deep Roots

Slow and deep watering is necessary to ensure even and adequate moisture is delivered to all roots and soil surrounding the plant. Over time, the frequency of monitoring and watering should decrease, but the duration of watering should increase. This process provides moisture when root systems are still tender and encourages deeper root growth as the plant begins to establish itself. The end result is deep-rooted plants that only require watering on an as-needed basis.

Protect from Frost

Young plants with unestablished shallow root systems are more susceptible to frost damage during the winter. Water plants and ensure even soil moisture prior to hard frosts to help protect plants from frost and root damage.

Japanese Stiltgrass

Management for Homeowners

Identify before proceeding with any management technique. Japanese stiltgrass has many native look-alikes. Removing native plants by mistake undermines any benefit of removing stiltgrass. Identification characteristics are located on the back of this handout.

Mow in early to mid September, before seed has developed. Monitor until the first frost to ensure any regrowth does not develop seed. To be effective, suspend mowing activities throughout spring and summer.

Hand Pull throughout the growing season by pulling the plant in its entirety. If followed by regrowth from seed stored within the soil, continue to hand pull or mow in the fall as described above. In combination with fall mowing, this approach depletes the seed bank faster but requires more energy and effort. Hand pulling is most suitable for small scale areas.

Mulch and Seed with native species to discourage regrowth of Japanese stiltgrass. Native groundcovers and naturally occurring leaf litter, as well as a dense forest sub-canopy and shrub layer, create a more resilient native plant community.

Monitor for a minimum period of 5-7 years.

Chemical Management

Chemical control of Japanese stiltgrass should be performed by licensed professionals.

Japanese Stiltgrass

Microstegium vimineum

Photo Credit: Monroe County IRIS[2]

Distinguishing features:

Leaf tapered at both ends with pale shiny midrib on upper surface; no hairs at nodes of stems; leaves without scabrous edges; flowers and fruits later in fall than most native grasses with some overlap; stems turn bright red in fall.[1]

Native look-alikes:

Whitegrass *(Leersia virginica)*
Smartweed (*Polygonum spp.)*

Native alternatives:

Inland sea oats (*Chasmanthium latifolium)*
Virginia wildrye (*Elymus virginicus)*
Little bluestem (*Schizachyrium scoparium*)
Indiangrass (*Sorghastrum nutans*)

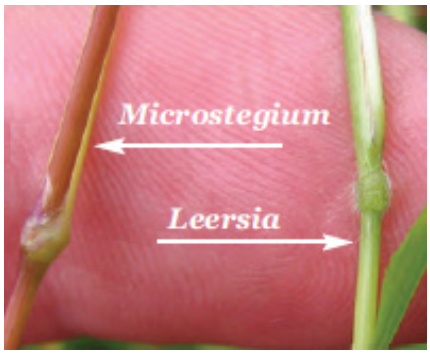


Photo Credit: Mistaken Identity? Invasive Plants and their Native Look-alikes.[1]

References

1. Sarver M, Treher A, Wilson L, Naczi R, Kuehn F. Mistaken Identity? Invasive Plants and their Native Look-alikes [Internet]. Dover (DE): Delaware Department of Agriculture; 2008 [cited 2014 Jul 15]. Available from: http://www.nybg.org/files/scientists/rnaczi/Mistaken_Identity_Final.pdf

2. Top 10 Invasives in Monroe County, Indiana [Internet]. Monroe County's Identify and Remove Invasive Species. [cited 2014 Oct 3]. Available from: http://mc-iris.org/top-10-invasives.html

Consult A Pro

When and How to Engage an Expert

Knowledgeable professionals are available to homeowners and HOAs interested in managing, improving, or stewarding the green spaces around them. Engaging an expert can save money and resources, help you make informed management decisions, and even mediate in contentious situations.

When to Contact a Professional

Whether you are looking to restore a degraded ecosystem or simply plant a tree, it is important to identify your goals and make a well informed plan of action. Professional recommendations should be considered any time there is uncertainty or if a situation exceeds your expertise. Care and consideration should be given to situations that involve potential hazards to humans or property, significant expense of resources, or irreversible actions.

What to Look for in a Professional

When seeking guidance from a consultant it is important to be aware that the depth of one's expertise often limits the breadth of their perspective. Professional recommendations may be limited in scope or biased by profession, background, experience and company values. For example, a professional who is paid to cut down trees is more likely to advise the removal, rather than pruning, of trees. Ideally, advice should be attained from experienced and credible professionals with a holistic and interdisciplinary approach.

How to Find a Professional

If you find that you are in need of professional advice, the best place to start is with a clear list of goals, questions and concerns. With this information, you can identify the type of professional you need and begin a search for consultants. A list of resources in the appendix of the Bolin Forest Urban Forest Stewardship Report provides a place to start.

In general, seeking input from more than one source is the most reliable way to ensure a holistic and balanced perspective.

Appendix 2: Additional Resources

Urban Forestry Resources:

NC Urban and Community Forestry

http://www.ncforestservice.gov/Urban/Urban_Forestry.htm

The North Carolina Urban Forestry department assists individuals, communities, professional associations, businesses and educational institutions, among others, by providing funding, education, and technical assistance to help protect urban forests and the benefits they provide.

NC Urban Forest Council

http://www.ncufc.org/

The Mission of the Council is to advocate the sustainability of North Carolina's urban forests through the use of economic, human, and environmental resources. The NC Urban Forest Council provides valuable resources, strategic planning and advocacy, as well educational materials to inform the public about North Carolina's urban forests and promote interest and participation in urban forest stewardship.

Sustainable Urban Forest Coalition

www.urbanforestcoalition.com

The SUFC is an assembly of national organizations working to advance a unified urban forest agenda for our nation's communities. It is composed of city planners, educators, landscape architects, non-profit leaders, scientists, arborists, foresters, nurserymen and women, and many other professionals who care for, monitor and advocate for trees and our urban forests as a whole.

i-Tree - Tool for Assessing and Managing Community Forests

www.itreetools.org

i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools.

Vibrant Communities - Trees are the key

www.treesarethekey.org

The Vibrant Communities initiative is working to ignite action around the Vibrant Cities recommendations, fostering green and healthy places where people live, work and play.

Carrboro, Chapel Hill, and Orange County Resources:

Town of Carrboro

www.ci.carrboro.nc.us

Carrboro Vision 2020 - Environmental Protection and Promotion

www.ci.carrboro.nc.us/documentcenter/view/1371

Vision2020 is a policy-making document for the Town of Carrboro to use in the planning of its future. It is a care taking tool, as well, designed to preserve the Town's history and qualities in an atmosphere of desirable growth.

Carrboro Land Use Ordinance - Appendix E - Screening and Trees -A Guide for Landscaping

http://www.ci.carrboro.nc.us/DocumentCenter/Home/View/674

Chapel Hill - Tree Protection Ordinance

www.townofchapelhill.org/trees

The Tree Protection Ordinance establishes a new vision statement that calls for protection of the Town's tree canopy cover. The ordinance is linked to a Town-wide commitment to sustainability with the potential to reduce carbon emissions and decrease the urban "heat-island" effect.

Friends of Bolin Creek

www.bolincreek.org

Friends of Bolin Creek is a 501 (c) 3 non-profit organization committed to conserving, protecting and advocating for the Bolin Creek watershed. We promote cost-effective, long-term solutions to enhance the environmental, recreational, and economic value of this unique North Carolina natural resource.

North Carolina Resources:

NC Invasive Plant Council

www.nceppc.weebly.com

The NC-IPC is a state chapter of the Southeast Exotic Pest Plant Council that facilitates solutions to problems caused by invasive plants. Our active membership includes public and private land managers, ecological consultants and researchers, planners, volunteer stewards, and concerned citizens.

North Carolina Native Plant Society

www.ncwildflower.org

Formed in 1941, the North Carolina Native Plant Society aims to promote the enjoyment and conservation of North Carolina's native plants and their habitats through education, protection, propagation, and advocacy.

North Carolina Botanical Garden

www.ncbg.unc.edu

The North Carolina Botanical Garden is part of The University of North Carolina at Chapel Hill. We further the University's mission of teaching, research, and public service through our own mission: "To inspire understanding, appreciation, and conservation of plants in gardens and natural areas and to advance a sustainable relationship between people and nature."

North Carolina State University - Going Native - Urban Landscaping for Wildlife with Native Plants

www.ncsu.edu/goingnative

As more people use native plants in their urban landscaping, it adds to the available habitat for wildlife and benefits the community as a whole. Going native helps save our natural heritage for future generations.

North Carolina Department of Environmental Resources

www.portal.ncdenr.org

The organization, which has offices from the mountains to the coast, administers regulatory programs designed to protect air quality, water quality, and the public's health.

North Carolina Department of Environment and Natural Resources - Water Quality BMP Guide

http://portal.ncdenr.org/web/lr/bmp-manual

The purpose of this manual is to assist designers, developers, owners, contractors, and local officials in determining what stormwater regulations apply to their situation, what the best stormwater BMP to meet those regulations might be, and how to then design and maintain that particular stormwater BMP.

North Carolina Environmental Education

www.eenorthcarolina.org

The environmental education section of the N.C. Office of Environmental Education and Public Affairs in the N.C. Department of Environment and Natural Resources was established to increase environmental literacy and natural resource stewardship in North Carolina by encouraging, promoting and supporting environmental education programs, facilities and resources throughout the state.

North Carolina Natural Heritage Program

www.ncnhp.org

The North Carolina Natural Heritage Program is part of the Office of Land and Water Stewardship within the N.C. Department of Environment and Natural Resources. The program serves as an information clearinghouse in support of conservation of the rarest and most outstanding elements of natural diversity in the state.

Firewise Landscape Guidelines – NCSU Cooperative Extensions

www.content.ces.ncsu.edu/firewise-landscaping-in-north-carolina.pdf

This publication summarizes some basic firewise concepts to use when creating a landscape around your home. It also provides lists of native plants by their flammability ratings so homeowners can make informed decisions when selecting and maintaining plants.

Venomous Snakes of NC – Natural Sciences Museum

www.naturalsciences.org/sites/default/files/files/documents/Venomous_Snakes_of_NC.pdf

This publication is a basic guide to the identification of North Carolina's venomous snakes. Distribution maps and natural history information are provided for each species, along with conservation information and additional references.

Additional Resources:

American Forests - 140 Years of Protecting and Restoring Forests

www.americanforests.org

We are people who care about – and for – forests.

American Forests, the oldest national nonprofit conservation organization in the country, advocates for the protection and expansion of America's forests. Since 1990, we have planted more than 45 million trees. We restore watersheds to help provide clean drinking water. We replant forests destroyed by human action and by natural disasters.

Sustainable Forests Roundtable

www.sustainableforests.net

The Sustainable Forests Roundtable is an open and inclusive process committed to the goal of sustainable forest management on public and private lands in the United States. Roundtable participants include public and private organizations and individuals committed to better decision-making through shared learning and increased understanding.

Wildfire Risk Assessment Guide for Homeowners in the Southern United States

http://www.interfacesouth.org/products/publications/wildfire-risk-assessment-guide-for-homeowners-in-the-southern-united-states/index_html

Wildfires are an important and necessary occurrence in many natural areas of the southern United States, but they also present a risk to homes constructed in, or next to, such areas. All homes are not equally at risk for a variety of reasons. Risk assessment allows homeowners to evaluate their particular exposure to fire as well as the critical factors that increase their risk. This guide will help you determine your risk and how to reduce it.

Green Roots Environmental Design

www.greenrootsenvironmental.com

To get in touch with Green Roots Environmental Design, please visit us at www.aedanworkshop.com or email us at connect@aedanworkshop.com