

# South Carolina



## Planning Education Advisory Committee

Committee Members:

Stephen G. Riley, Chairman  
Representing MASC  
Term Expires: 2017

Phillip L. Lindler  
Representing SCAC  
Term expires: 2019

Cliff Ellis  
Representing Clemson University  
Term expires: 2020

Christopher Witko  
Representing USC  
Term expires: 2020

Wayne Shuler  
Representing SCAPA  
Term expires: 2018

February 27, 2018

City of Myrtle Beach  
c/o Carol Coleman  
P.O. Box 2468  
Myrtle Beach, SC 29578

Re: Applications for Accreditation of CE credits for New Program

Dear Ms. Coleman:

On February 23, 2018, I received the program materials you submitted for "Strengthening Tree Protection Planning." Upon receipt of the materials, an email was sent to confirm receipt by all Committee members as well as a deadline set for comments.

Your application has been approved, the signed "Notice of Decision" is attached herein. A formal after-the-fact approval will be handled as part of a Consent Agenda at the regular quarterly meeting of the Committee, scheduled at 10:00 a.m. on Tuesday, May 1, 2018.

Thank you for your efforts to help make this program a success.

Sincerely,

Stephen G. Riley, ICMA~CM  
Chairman

cc: Phillip Lindler, Cliff Ellis, Christopher Witko and Wayne Shuler

*South Carolina Planning Education Advisory Committee (SCPEAC)*

**NOTICE OF DECISION**

**Title of Program:** Strengthening Tree Protection Planning

**11. The following action has been taken by the SCPEAC on this application:**


ACCEPTED WITHOUT OBJECTION      Date: \_\_\_\_\_

REVIEWED BY FULL COMMITTEE      Date: February 27, 2018

- a)      X   ACCREDITED for: 90 min. CE credits: 1.5
- b)    \_\_\_\_\_ DENIED ACCREDITATION
- c)    \_\_\_\_\_ RETURNED for more information

**12. If accredited:**

- a)    Authorized Course No.: 2018-03
- b)    Date of accreditation: 02/27/2018

Signature of SCPEAC Representative: \_\_\_\_\_  


**For further information, contact Mr. Stephen G. Riley, Chairman,  
843-341-4701 or [steve@hiltonheadislandsc.gov](mailto:steve@hiltonheadislandsc.gov)**

South Carolina Planning Education Advisory Committee (SCPEAC)

**LOCAL OFFICIAL'S CERTIFICATION OF NEED  
FOR CONTINUING EDUCATION PROGRAM**

**NOTE:** The Planning Director of a jurisdiction, or the COG Director serving a jurisdiction, may certify to the SCPEAC that a particular continuing education program is appropriate to meet the needs of that jurisdiction.

This certification form, together with the required information referenced therein, shall be submitted to the Committee. **If no objections are raised** by a member of the SCPEAC within 10 working days of receipt, the continuing education program shall be considered accepted. If an objection is raised, a teleconference meeting shall be scheduled, with appropriate public notice, as soon as reasonably possible, to review the application.

Applications are due no later than 30 days prior to the first scheduled presentation of a program or class. The Committee will consider extenuating circumstances where the 30 day deadline cannot be met.

**1. Certifying Official's Information:**

- a. Name: Carol Coleman
- b. Title: Planning Director
- c. Jurisdiction for which certification is being made: City of Myrtle Beach
- d. Address of Jurisdiction: P.O. Box 2468
- e. City: Myrtle Beach, SC  
Zip Code 29578
- f. Telephone: 843/918-1069
- g. Email: dmckenzie@cityofmyrtlebeach.com
- h. For COG Directors:
  - i. Name of COG: Waccamaw Regional Council of Governments
  - ii. Address of COG: 1230 Highmarket Street
  - iii. City: Georgetown, SC  
Zip Code: 29440
  - iv. Telephone: 843/436-6130
  - v. Email: Mark Hoeweler <mhoeweler@wrcog.org>

**2. Information on Educational Program:**

- a. Title of Program: Strengthening Tree Protection Planning
- b. Name of Organization that is providing or sponsoring the Program:
  - i. Organization: City of Myrtle Beach Planning Department

ii. Street Address: 937 Broadway Street

iii. City: Myrtle Beach

State: SC

Zip Code: 29577

iv. Contact Person: Diane Moskow-McKenzie

v. Title: Senior Planner

vi. Telephone: 843/918-19069

vii. Email: dmckenzie@cityofmyrtlebeach.com

c. Date(s) and Location(s) of Program:

March 6, 2018 City of Myrtle Beach Planning Department Conference Room

d. Briefly describe the program and why it is relevant to your jurisdiction:

PC would like more information on protecting trees in order to carry on a dialogue with developers when they are challenging saving trees

**3. Method of presentation (check all that apply. All sessions must have a Coordinator present):**

- a. Presentor(s) in room with participants
- b. Live presentation via close circuit TV, video conferencing, or similar; Coordinator present
- c. Videotape or CD/DVD presentation; Facilitator present
- d. Webinar or similar; Coordinator present
- e. Other (describe) \_\_\_\_\_

**4. Description of materials to be distributed (check/fill in all that apply):**

a. Powerpoint handout:	<input checked="" type="checkbox"/>	number of slides:
b. Other handouts:	<input type="checkbox"/>	total pages:
c. CD/DVD:	<input type="checkbox"/>	
d. Other (describe)		_____
e. None:	<input type="checkbox"/>	

**5. When are materials distributed?**

- a. Sent before the program:
- b. Handed out at the program:
- c. Other (describe) \_\_\_\_\_

**6. Required attachments (5 copies distributed as described below):**

- a. Course description and outline including estimated time per section

- b. Brochure, if available
- c. Course Presenter(s) and credentials (include brief resumes and qualifications)
- d. Copies of all handouts and course materials
- e. Evaluation Form and method of evaluation (each program must be evaluated)

**7. Instruction Time:**

- a. Indicate the total minutes of instruction time: 90

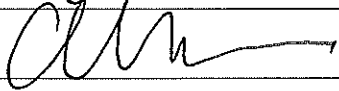
**Note:** Breaks, meals and introductions should not be counted. A reasonable period of Q and A should be included and counted.

**8. Local contact person (if other than Certifying Official):**

- a. Name: Diane Moskow-McKenzie
- b. Title: Senior Planner
- c. Jurisdiction: City of Myrtle Beach
- d. Telephone: 843/918-1069
- e. Email: dmckenzie@cityofmyrtlebeach.com

**9. Certification. By Submitting this application, the applicant agrees to:**

- a. Allow in-person observation, without charge, of the Program by the SCPEAC Committee members. Any food, travel or lodging costs will be the responsibility of the Committee member(s).
- b. The Certifying Official acknowledges that its approval for this Program may be withdrawn for violations of the regulations or failure to comply with the agreements and representations contained herein and as may be required by the SCPEAC.
- c. I do hereby certify that this program satisfies the current continuing education needs of this community.

- i. Name: Carol Coleman
- ii. Title: Planning Director - City of Myrtle Beach
- iii. Signature: 
- iv. Date: February 23, 2018

**Application and all Materials may be submitted in one of the following means:**

1. Electronic submission to each of the committee members listed below via email; or
2. Hardcopy via U. S. Mail, 1 copy each to each committee member; or
3. Electronic submission of the application via email to all committee members, and submit hardcopy supporting materials via U.S. Mail to each member, if materials not available electronically.
4. Please cc all applications to the Chairman's assistant, Krista Wiedmeyer at [kristaw@hiltonheadislandsc.gov](mailto:kristaw@hiltonheadislandsc.gov)

To access committee members email and postal addresses visit the link below:

<http://www.scstatehouse.gov/scpeac/members.htm>

South Carolina Planning Education Advisory Committee (SCPEAC)

**NOTICE OF DECISION**

**10. The following action has been taken by the SCPEAC on this application:**

<input type="checkbox"/> ACCEPTED WITHOUT OBJECTION	Date: _____
<input type="checkbox"/> REVIEWED BY FULL COMMITTEE	Date: _____

**11. Committee Action:**

<input type="checkbox"/> ACCREDITED for _____	_____ CE credits
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DENIED ACCREDITATION

i. Reason: \_\_\_\_\_

RETURNED for more information

**12. If accredited:**

Authorized Course No: \_\_\_\_\_

a. Date of accreditation: \_\_\_\_\_

b. Certification is valid until: \_\_\_\_\_

Signature of SCPEAC Representative: \_\_\_\_\_

**For further information, contact Mr. Stephen Riley, Chairman,  
843-341-4701 or [stever@hiltonheadislandsc.gov](mailto:stever@hiltonheadislandsc.gov)**





South Carolina Planning Education Advisory Committee (SCPEAC)

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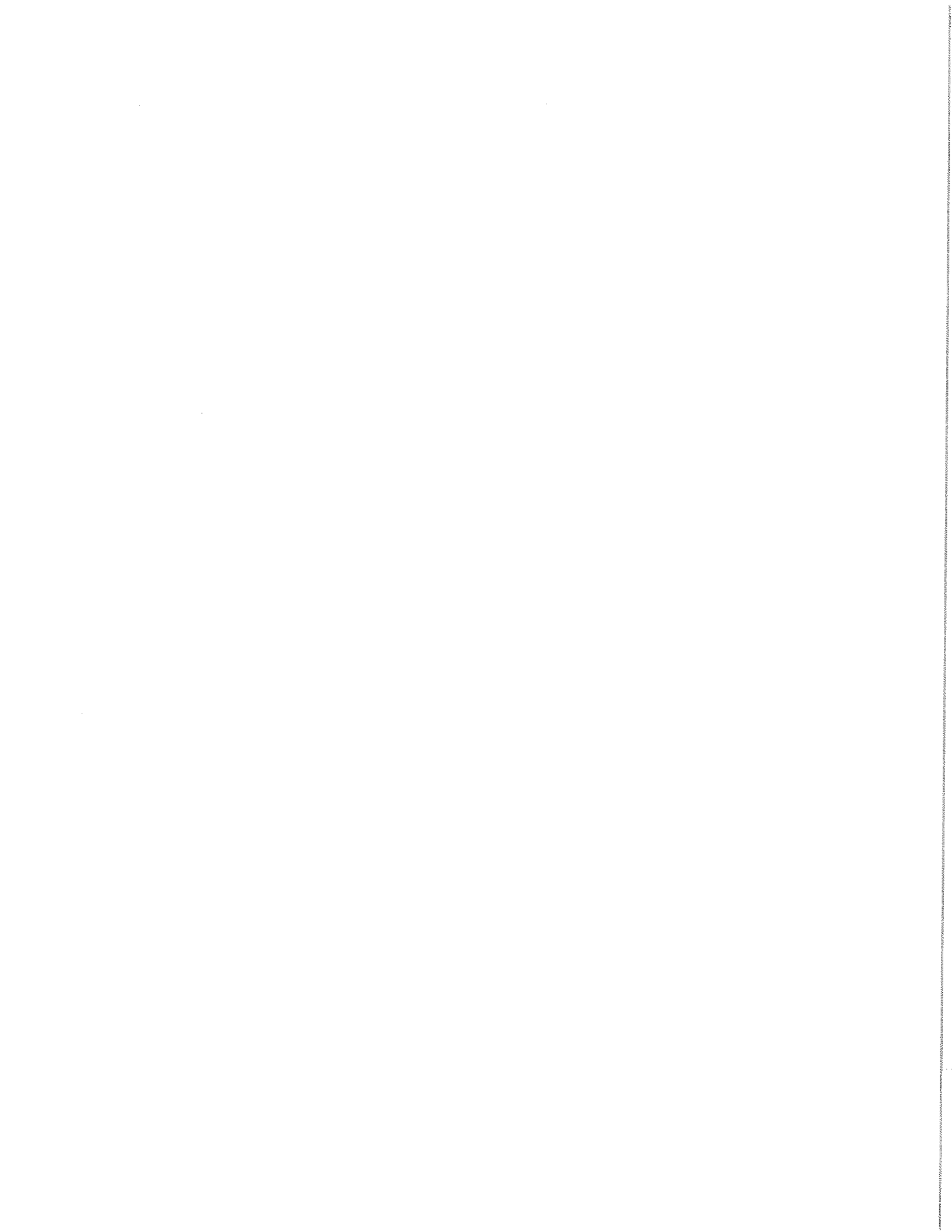
**For further information, contact Mr. Stephen Riley, Chairman,  
843-341-4701 or [stever@hiltonheadislandsc.gov](mailto:stever@hiltonheadislandsc.gov)**



Strengthening Tree Protection Planning  
March 6, 2018, 2:00 - 3:30 p.m.  
First Floor Conference Room, City Hall  
937 Broadway Street, Myrtle Beach, SC

Course Description: The purpose of the program to help our boards and commissions better understand tree protection through identification of trees in decline and protecting trees during construction. The boards and commissions are challenged on a regular basis by contractors and developers on what trees should be saved. This course will provide the board and commission members with knowledge and expertise to have an educated dialogue when challenged on their decisions about tree protection planning.

- I. The Importance of Trees - 10 minutes
- II. Trees in Decline - 40 minutes
- III. Protecting Trees During Construction - 40 minutes



# Lois Edwards

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## Education

Clemson University Clemson, South Carolina  
Bachelor of Science in Forest Management 1979

## Work experience

South Carolina Forestry Commission May 1979- July 2010

- Sandhills State Forest 1979
- Project Forester of Horry County 1980-1999
- Pee Dee Region Urban Forester 1999-2010

## Certifications

South Carolina Registered Forester #814  
ISA Certified Arborist SO-1378A since 1996  
Public Information officer (PIO) qualified for National All Hazard Incident Management Team  
US Forest Service Urban Forest Strike Team  
Prescribed Burning Manager

## Organizations and Leadership positions

International Society of Arboriculture (ISA) Southern Chapter

- Conference chairman for Southern Chapter conference in Charleston, SC (2000)
- State Director for South Carolina on Board of Directors for 6 years (2000-2006)
- Leadership School participant In Champaign (2007)
- Vice-President (2007), President-elect (2008), President (2009), Past President (2010)

Member of TreesSC (formerly the SC Urban and Community Council ) since 1991

- Conference committee and awards committee

Member of Society of Municipal Arborists

- Municipal Forestry Institute 2009

Arbor Day Foundation

- Present Tree City USA awards to cities and towns in South Carolina

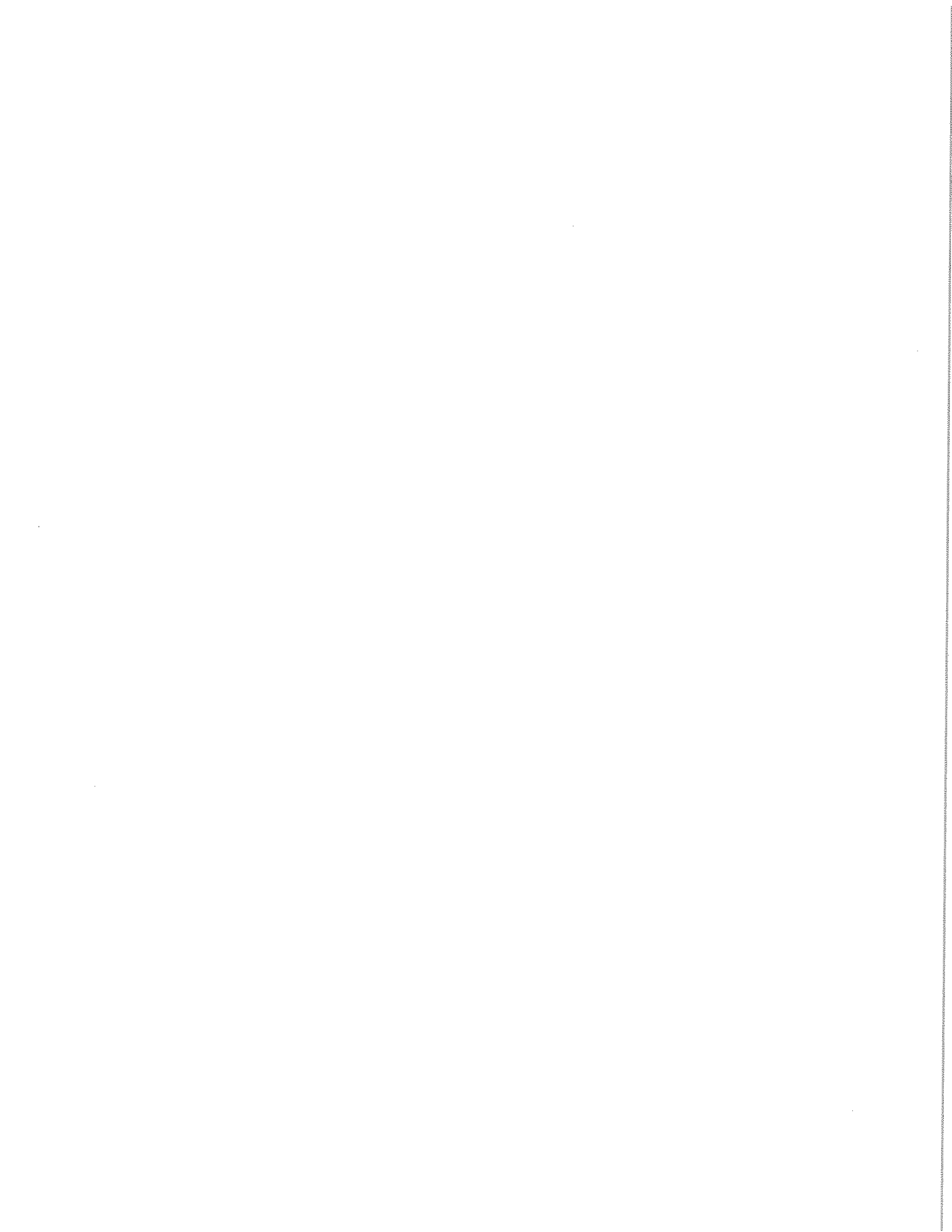
## Honors and Awards

Award for Excellence in Arboriculture Education presented by ISA Southern Chapter 2006

Conservation Service Award presented by the Horry County Soil & Water Conservation District in 1999

Proclamations honoring years of service to their city by the City of Myrtle Beach and the City of Conway.

Presented 'Key to the City' by the City of Darlington



## Tree Protection Planning Evaluation Form

1. Did the presentation help you to better understand how to respond to questions or challenges about tree protection?

Yes  No

2. Was the presenter knowledgeable in this field and helpful to you?

Yes  No

3. Do you have any questions about tree protection that the presenter covered or did not cover? Please write your question(s) here \_\_\_\_\_

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(We can share the response to your questions at your next commission or board meeting.)

4. Do you have any tree protection concerns that you would like to share with the City or the presenter? \_\_\_\_\_

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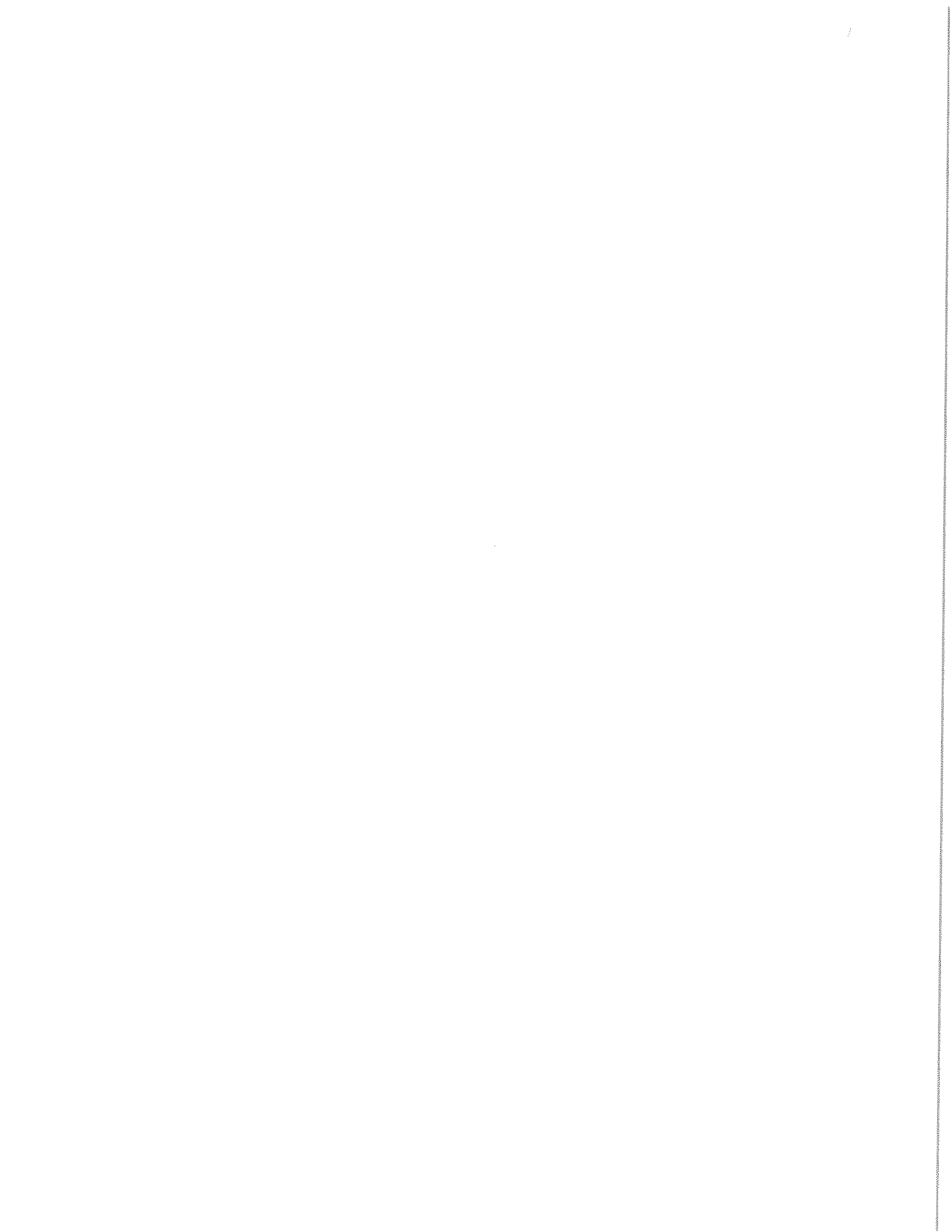
5. What other planning related topics would you like to receive training on? \_\_\_\_\_

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### Introduction

Trees that decline or die usually are suffering from a combination of stress factors. Insects and diseases are often secondary, attacking trees weakened by other factors.

Diagnosing the disorder is the first step. Making the appropriate recommendation and treatment is the most important.

A knowledge of plant disorders, pests and pathogens is important, as are experience, observation and reasoning.

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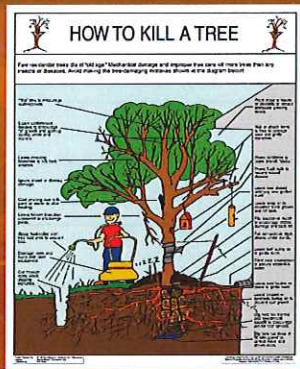
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### The Ideal Tree

- Grown in the Forest
- Nutrient Recycling
- Untouched by Man
- Full Crown/Canopy
- NO TARGET!

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### How To Inspect A Tree

- Talk with the Property Owner
  - History of the Tree
- Site Characteristics
  - Disturbance?
- Root Collar Inspection
  - Missing or Broken Roots, Decay Fungi Present
- Visual Trunk Inspection for Holes, Decay, Insects
- Thorough Inspection of the Canopy
  - Broken or Dead Limbs, Cracks, Crooks, etc.

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### 7 Common Defects in Trees that Predispose them to Failure

1. Decayed Wood
2. Cracks
3. Weak Branch Unions
4. Root Related Problems
5. Cankers
6. Poor Form
7. Deadwood

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### General Diagnosis Principles

Ask questions.

- How long has the problem been going on?
- What were the early symptoms?
- Has there been any construction, excavation, trenching, or chemical treatment in the area?



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### Symptoms and Signs

**Symptoms** are how a tree responds to a disorder—the effects of the causal agents or factors apparent on a tree. Examples: chlorosis, wilting, leaf scorch.

**Signs** are direct indications of causal agents, or something left behind. Examples: fungal conks, insect frass, emergence holes, discarded skins.



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### Diagnosis

1. **Accurately identify the plant.** Many pests and pathogens are specific to certain host trees
2. **Look for a pattern of abnormality.** Compare with normal, healthy trees. *Biotic agents rarely show uniform patterns.* Abiotic agents may cause damage over large areas and *different species.*
3. **Carefully examine the site.** Light levels, soil characteristics, water availability, prevailing winds, obstructions, chemicals, compaction, age of the community, etc.
4. **Note color, size and thickness of foliage.** Foliage abnormalities are often the first thing noticed, but often the cause is elsewhere.

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### Diagnosis

5. **Check the trunk and branches.** Check buds and bark for discoloration & drying, and wounds on the trunk. Look for exit holes, profuse water sprouts, etc. Length of internodes and distance between terminal bud scale scars indicate vigor.
6. **Examine the roots & root collar.** The hidden part of the tree is often where the problem originates. Look for decay, fungus conks, soil and moisture conditions, or girdling roots. Healthy roots are generally white inside, fleshy, flexible and firm. This indicates adequate oxygen levels (*aerobic* conditions). Brown roots may indicate dry soil or chemical contamination. Black roots indicate overly wet soils or root rot pathogens. *Anaerobic* conditions are often indicated by a sour smell.

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### Diagnosis

Poor plant health is rarely due to a single factor. The cause is usually a complex of biotic and abiotic stressors. Abiotic stresses usually precede insect or disease attacks:

- Soil compaction
  - Moisture fluctuations
  - Temperature extremes
  - Mechanical injuries
  - Poor species selection
  - Inadequate root space
  - Grade changes
  - Paving
- Older/larger trees are more susceptible to these stressors!

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Stress factors are cumulative. As they add to one another they can put a tree into an irreversible decline.

If stress factors are detected and corrected soon enough, decline can be reversed.

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### Symptoms of Root Problems

- Decline or Dieback of the Canopy
- Presence of Fungal Fruiting Bodies at the Root Collar
- Dead, Missing, or Broken Roots

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### Indicators of Decay

Decay is often a "hidden defect," but some indicators can help in evaluating its presence and extent.

Dieback	Fruiting bodies	Cavities
Cracks	Seams	Swelling
Old pruning wounds	Dead branches	
Open wounds	Sloughing bark	Oozing
Topping cuts	Cavity-nesting animals	Bees

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### Physical or Physiological Injury?

Physical injuries are acute, physiological injuries are chronic, as a rule.



Exception: a chronic, physical injury.

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### Weather-related Problems

- Moisture extremes
- Wind
- Snow
- Ice
- Wind
- Lightning
- Hail
- De-icing salts
- Freezing



Proper structural pruning could have prevented this ice damage.

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### Pollution Damage

Damage by pollutants can be either acute or chronic. Many factors affect the degrees of damage, such as concentration of pollutant, length of exposure, wind, precipitation, temperature, time of year, humidity, soil type and grade, species and condition of the tree, etc.

Symptoms may mimic other problems.

What clues might you see that would indicate pollution damage?

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### Chemical Injury

Chemicals used in the landscape and vegetation management industries can damage or kill trees. Herbicides contain *phytotoxins*. Growth regulating chemicals used in turfgrass management, such as 2,4-D or Dicamba (often found in "weed and feed" fertilizer products) may harm non-target plants. These chemicals are *systemic*, because they move throughout the plant.

Wind drift, accidental application, soil movement, root grafting or volatilization can transfer chemical to non-target plants.

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### Water Availability

Flooding or over-irrigation saturates the soil, causing trees to stop aerobic respiration and switch to anaerobic fermentation. This uses a great deal of stored food to release a small amount of energy, quickly starving the tree. Byproducts of fermentation can be toxic.

Flooded conditions can also alter the soil biology, promoting the growth of bacteria and fungi that can be harmful to trees (Example: *Phytophthora*), and can kill beneficial bacteria and fungi in the soil.

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### Diseases

Blight of shoots and twigs often exhibit symptoms on leaves. Cankers can be associated with blights.

Tissues beneath the bark of a canker are usually dead, along with leaves & stems around it.

*Nectria* canker on hardwood



Fusiform rust canker on pine

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### Diseases

#### Vascular Wilts



Dutch elm disease (above) and fire blight on crabapple

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### Diseases


*Armillaria* on oak



*Ganoderma* on oak



*Phaeolus* on white pine



*Heterobasidion* on yellow pine



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**Risk assessment:** the process of evaluating the likelihood that part or all of a tree will fail and cause damage and/or injury.



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**Failure potential:** the likelihood that an entire tree or part of a tree will break and fail within a given time period.

Considerations:  
species, growth habit,  
defects, quality of  
branch attachment,  
condition of the root  
system, lean, and  
history of the tree  
and site.



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Trees fail when the **load** they experience exceeds their structural capacity. The environment also plays a role:

- Winds
- Snow and ice loading
- Lightning
- Rainfall
- Abrupt environmental changes (wind exposure, soil conditions, slope, etc.)



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### Site History:

- Construction, grade changes or trenching within the root zone.
- Removal of adjacent trees that served as a wind buffer.
- Replacement of sidewalks and root loss (root pruning)
- Failure of nearby trees due to root disease.
- Changes in wind dynamics due to new structures on the site.

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### Tree Assessment

The ability to predict tree failure is limited, but we can learn to identify characteristics that have been associated with tree failure.

*Structural defects* that can lead to failure are not always visible, especially those inside the trunk or underground, and the forces of nature that will act upon them are unpredictable.



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### Tree Assessment

Minor defects and significant weaknesses can be discerned with training and experience. The arborist should be familiar with

- Tree species and typical modes of failure
- Normal growth traits
- Structure and form
- Signs of decay.

Remember that tree health and structure (or soundness) are not the same.

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### Tree Assessment

It's important to be systematic and consistent when performing an inspection to learn all you can about the tree, the history and the site.

The first step is to assess the tree as a whole, using a *visual tree assessment*, or *VTA*.

- Look for dieback, gaps or discoloration in the crown
- Take note of any lean
- Look for branches extending beyond the rest of the crown
- Examine trunk taper
- Inspect the trunk the root collar and the root zone.

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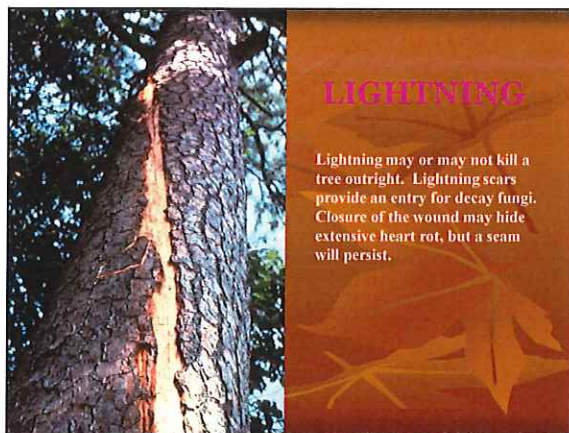
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### Mitigation Options

*Mitigation* is the process of reducing risk to an acceptable level. Pruning is a primary recommendation for trees that will not be removed. Some options are:

- Reduction pruning
- Support systems
- Target removal
  - Fencing
- Posting signs

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### Mitigation Options

An *inspection cycle* should be chosen that is appropriate for the species, size, age, condition and management practices. Most risk management programs call for follow-up inspections on a predetermined schedule.



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### Types of Cracks

- Horizontal Cracks
  - Imminent Risk-tree is failing
- Vertical Cracks
  - Shear Cracks-completely goes through the stem or tree.
  - Inrolled Cracks (aka ram's horn)-may cause the tree to never completely seal off a wound. Must test for shell thickness.

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### WEAK BRANCH UNIONS

- Branch Formed from a Topping Cut
  - Decay within Branch Bark Ridge
- Branch Union with Included Bark
  - V-shaped crotches vs. U-shaped crotches
  - Bark growing inside the union

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### CANKERS

- A Localized Sunken Area Where Bark and/or Cambium are Dead
- Caused by Insects/Diseases, Mechanical Wounds
- Limits the Sealing Process (CODIT) of the Tree
  - As the tree adds new wood each year, the cankered area will not be able to do so and therefore cause a possible structural failure.
  - >40% of stem affected = HR

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Trees can greatly enhance a property's environmental, aesthetic and economic value. A development site with existing trees can be developed in such a way as to save established, mature trees. If proper steps are not taken, many of the trees will be lost in subsequent years.

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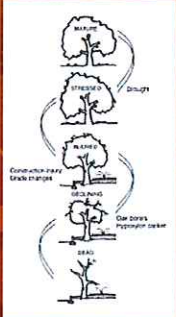
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### How Trees Are Damaged During Construction



Damage by construction equipment is inevitable unless measures are taken to keep equipment away from trees.

Damage to trunks and limbs can allow decay to infect a tree and cause failure many years in the future.

Damage to soil and roots may not be apparent for years, or may result in the sudden loss of a tree during hot, dry weather.

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### Physical Injury to Trunk and Crown

Remember that any injury to a tree is permanent, even if it is compartmentalized. Decay may shorten the useful life of a tree, even if it survives.



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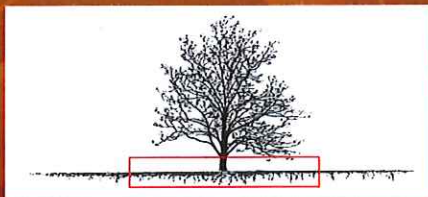
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### Cutting of Roots

Since most tree roots occur in the upper few inches of soil, but may extend far beyond the drip line of the tree, and digging, trenching, or grading can sever a major portion of a tree's root system. The extent of damage depends on how close to the trunk the damage occurs.



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### Soil Compaction



Soil compaction crushes shallow roots, reduces pore space, inhibits water infiltration, impairs drainage, reduces O2 available to the roots, reduces growth, and may lead to serious tree decline.

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### Root Suffocation

Raising the grade by adding soil ("fill dirt") can suffocate fine roots. Roots need to be able to exchange CO2 and obtain O2 from the soil. Even a shallow fill of fine-textured or compacted soil inhibits this exchange.

The effects of soil fill may not be seen for many years, as the roots slowly die. Changes in the water table or drainage patterns can also be affected by soil fill, and can result in tree decline.

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### Exposure to the Elements

Trees growing in a forest situation benefit from the protection of surrounding trees. When a forest tree is suddenly left standing alone, it may suffer from sunscald, uprooting or breakage in storms.



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### Construction Practices

If tree preservation is to succeed, trees must be considered in each phase of land development. This includes planning, design, grading, construction and maintenance. The usual sequence is:

- Site clearing and demolition to remove existing structures and vegetation that were not identified for preservation
- Rough grading to create the project's grade contours
- Installation of utilities, stormwater and sewer systems
- Grading for finish pads, roads and surface
- Construction of roads and buildings and installation of utilities
- Final grading and landscape installation

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### Planning and Preservation

Arborists should be involved at the earliest stages of development—preferably, the arborist should be the next person on the site after the surveyor.

Few professionals in the fields of engineer, building construction and even landscape architecture are knowledgeable about tree requirements.

The decision to preserve trees should consider the species, size, maturity, location and condition of trees. Younger, more vigorous trees stand a better chance of surviving the stresses of construction.

Unfortunately, many tree protection ordinances require the preservation of trees based solely on size.

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### Planning and Preservation

Trees should be inventoried, mapped and considered along with other landscape features such as built structures, wetlands, and wildlife habitat during the preliminary design phase.

The arborist should work with the landscape architect and others to prepare a plan that would show not only trees to be preserved, but also protection zones and details of mitigation and preservation measures.

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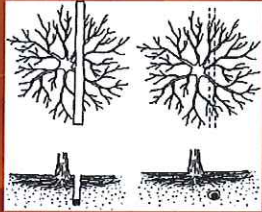
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### Planning and Preservation

Boring and *tunneling* are much less destructive to tree roots than trenching, and also more expensive. The value of the trees should be considered when evaluating costs. Plans to use tunneling must be made early in the planning process.



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### Specifications

All measures to be used in tree protection should be written into construction specifications. ANSI A300 (Part 5) and the Best Management Practices booklet, *Managing Trees During Construction*, are intended to be used in writing specifications.

Communication is crucial. Each subcontractor and equipment operator must understand the purpose of barriers, limitations and specified work zones. Signs should be posted to reinforce the importance of the *tree protection zone (TPZ)*.

Fines and penalties should be built into the specs, and the severity should be proportional to the potential damage to protected trees.

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### Avoiding Tree Damage During Construction

There are few options for treating trees severely damaged by construction. Prevention is of the utmost importance.

Where possible, measures should be taken to increase tree vitality prior to construction. This may include mulching, fertilization, water management, pest management or use of tree growth regulators.

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## Avoiding Tree Damage

### Barriers

Heavy-duty construction fences should be set up around trees chosen for preservation. The fence should encompass the *tree protection zone*, in which no activity or disturbance should be allowed without written approval and supervision by the arborist.

The TPZ should extend as far out from the tree as possible. On young, vigorous trees, a distance of one foot per inch of trunk diameter is usually adequate. For older or less tolerant trees, this distance should be increased. Within the fenced area, competing vegetation should be removed and mulch added to the entire area.

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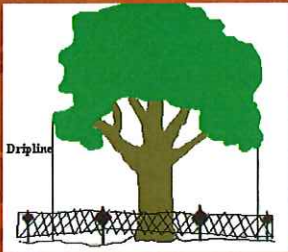
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## Tree Protection Zones



Remember that roots extend far beyond the drip line in most cases. The TPZ radius should be based on trunk diameter or should meet specs established in national standards.

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## Avoiding Tree Damage

### Limiting Access

It's best to allow only one access route onto a construction site. Ideally, this same route would be used as a utility corridor later, or for paved areas.

Areas should be provided and designated for storage, staging, parking, burning, cement washing, soil, and break or lunch area. If no such areas are designated, workers will move to shady spots for these activities—over the critical root zone!

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**Avoiding Tree Damage**  
**Reducing Compaction**

Soil compaction on a construction site can be reduced through the use of a coarse mulch, like wood chips, applied at a depth of 6 to 12 inches. Using plywood or steel sheets over the mulch gives added weight dispersal.

Deep mulch should be carefully removed when the project is completed. A mulch depth of 2 to 4 inches can benefit trees if left on the site, especially in the tree protection zone.

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**Avoiding Tree Damage**  
**Minimizing Effects of Grade Changes**

Grading can have short-term effects on trees by damaging or removing fine roots. Long-term, grading can change drainage patterns and remove the topsoil the supported the tree, both structurally and biologically.

The *hydrology* of a site (water movement both on the surface and within the soil) can change with grading, and may affect survivability of the trees.

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**Avoiding Tree Damage**  
**Minimizing Effects of Grade Changes**

If the grade around a tree must be lowered, retaining walls can be used around the tree protection zone to preserve roots, creating a tree island. This will change the hydrology in the vicinity of the tree, and large trees often will not survive even if this expensive option is used.

If the grade must be raised, retaining walls can be used to preserve the grade near trees. A tree pit, or dry well, is an expensive option that may result in drastically changed hydrology and is often unsuccessful in preserving trees.

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**Avoiding Tree Damage**  
**Minimizing Effects of Soil Fill**

Aeration systems, gravel or stone beneath fill, and other elaborate systems beneath soil fill have not been proven effective.

If fill must be added near trees, it should be of similar texture to the soil on site. Large equipment should not be used in adding soil fill—it will injure roots and cause compaction. Using small equipment and hand tools will minimize damage.

Soil moisture should be monitored in soil fill areas, and either irrigation or drainage provided, as needed.

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**Avoiding Tree Damage**  
**Communication**

One uninformed subcontractor can undo the most elaborate plans. The arborist should have a preconstruction meeting with all subcontractors and should physically visit the site as frequently as possible. Take photos at every stage of construction.

Construction-related tree damage may not show up for years after the project is completed. There should be continued monitoring of the trees' health, structure and overall vitality. Stress may lead to insect or disease problems that will need to be addressed.

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**Treatment of Trees Damaged by Construction**  
**Monitoring**

Despite all efforts, trees may be damaged during construction, and the effects of the damage may not appear for several years. Regular inspection and monitoring should not only monitor trees themselves (cracks, leans, dieback, decay indicators), but also drainage changes, soil condition and sun and wind exposure (Plant Health Care principles).

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