

Recovery

Best Management Practices for Municipalities



N.C. Forest Service Urban and Community Forestry

PROTECTION SERIES



1. Leadership

If you have not secured urban forest management expertise, you should for the recovery phase. An ISA Certified Arborist should be on hand for tree evaluations. Planning and management assistance would be of great value particularly if your community has suffered a significant event. The recovery phase is also the time you should engage your community forestry advisory committee in the process. Public involvement and support are a foundation for a successful recovery plan.

Event Response Debriefing

Assemble your Urban Forestry Response Team.

- Review your hazard remediation work documentation and the storm damage inventory for completeness of data collected and accuracy.
 - If your data lacks information or accuracy is in question, develop and implement a strategy to correct the deficiencies.
- Prepare a tree damage summary report of the findings of your review of the hazard remediation work documentation and the storm damage inventory for presentation to community leadership and your advisory committee.

The response phase is over, and hazardous tree remediation work is complete. The work is not finished. You are left with trees that have varying degrees of damage, and these trees can range in number from many to few. Your storm damage inventory has a list of trees that should be removed and pruned. Cull the severely damaged trees and prune the remaining damaged trees to reduce the risks of higher losses in the future. Your community trees provide services that enhance the quality of living in your community. Invest in maintaining your community trees as you do with other elements of your community's infrastructure and plant trees for the future to fully realize those benefits. Completing the work now will come at a cost, but the cost will be greater in the future if you do not act.



Invest in maintaining your community trees as you do with other elements of your community's infrastructure and plant trees for the future to fully realize the services and benefits trees provide in enhancing the quality of life in your community.

Recovery Planning Briefing

Assemble your advisory committee.

- Present the tree damage summary report.
- Set a schedule to develop your recovery plan.

2. Administrative

Objectives:

- Review your tree purchasing and planting methodologies, and determine the methodologies that match your community's needs and capacity.
- Select kinds and size of trees you will purchase.
- Select a procurement methodology that ensures purchasing of quality plant material and planting.

A. Tree Planting Procurement

Successful tree planting procurement is a function of the quality and handling of the plant material, proper planting, and supervision

Purchase Quality Nursery Stock

Garbage in garbage out. Poor nursery stock will not only have a low transplant survival rate, but will also come with poor branching structure. This translates to higher pruning costs and storm damage potential now and in the future. Purchase quality tree nursery stock.

Select Tree Nursery Stock Type and Size

Tree nursery stock is sold (packaged) as bare root, containerized and balled and burlap (B&B). All are acceptable choices. There are advantages and disadvantages to each. A general rule, the larger the plant material the lower the survival rate, and the price increases exponentially with size.



Specifications – Shade trees should have a single central stem running from the ground to the top to minimize storm damage potential. Specify branching height standards to minimize pruning for clearance on street trees.

Tree Nursery Stock Guidance

Type	Sale Size Measure	Advantages	Disadvantages
Bare Root: tree is dug and left with no soil around the roots	<ul style="list-style-type: none"> Caliper or height 1- to 2-inch caliper is ideal 	<ul style="list-style-type: none"> Low cost Light weight Ease of handling 	Must be kept in cold storage, short planting window from digging to planting, plant while dormant only, limited species selection, smaller size only
Containerized: grown and shipped with the roots in a container	<ul style="list-style-type: none"> Container size 	<ul style="list-style-type: none"> Handling and care during storage care, plant all year-round 	Becoming root/pot bound
B&B: dug with roots and soil, wrapped with burlap and wire basket		<ul style="list-style-type: none"> Plant all year-round, large sizes available 	Handling, cost

Quality Plant Material Specifications

- Source growing nursery located within same climate as your community
- Trees meet ANSI Z60.1 American Standard for Nursery Stock
www.americanhort.org
- Specify type and form such as single central stem and branching height for street trees.
www.isa-arbor/store/shop

Tree Planting Information Resources

- N.C. Forest Service Urban & Community Forestry – Selection, specifications and contracts
www.ncforestservice.gov
- NCSU Extension – Plant selection
<http://plants.ces.ncsu.edu>
- North Carolina Urban Forest Council – Selection and planting
www.ncufc.org



Bare root tree nursery stock type.



Container tree nursery stock type.



Balled & Burlap tree nursery stock type.

Stock Illustrations Courtesy: Arbor Day Foundation

Select Tree Planting Labor

With basic training, the proper equipment and interest, anyone can plant a tree properly. The limiting factors are the size of the nursery stock and equipment.

Tree Planting Guidance

Type	Excavation Equipment	Planting Labor
Bare Root & Container	<ul style="list-style-type: none"> Shovels, backhoe optional 	<ul style="list-style-type: none"> Volunteer, community staff, contractors
B&B	<ul style="list-style-type: none"> Backhoe 	<ul style="list-style-type: none"> Community staff, contractors

Supervision

Qualified supervision is required for successful tree planting. Your supervisor should have training and experience in selecting quality plant material and planting.

- Inspect plant material at the nursery or when it is delivered and reject poor quality.
- Supervise the storage and handling of plant material and tree planting to ensure it is completed properly.

B. Select Tree Planting Procurement Method

Based on the selections you have made above, choose your procurement method. You may purchase trees from a local nursery or supplier. Be sure the trees meet the quality standards discussed above. There are two common contract options: supply only, and supply and plant. With a supply only contract you will need to identify who will plant the trees. Just as was suggested with tree work, term and lump sum contracts are options. The most useful is a term contract as it can be used for multiple years. The following tables are examples of supply and plant contract bidding payment schedules.

Supply Bid

Species	Size	Form	Quantity	Unit Price	Extended Cost
Acer campestre "Carnival"	2.5 inch	B&B	10		
Cornus mas "Spring Glow"	6 foot	B&B, multi-stem	10		
Quercus rubra	1.5 inch	Bare Root	10		

Planting Bid

Unit	Quantity	Unit Bid Price	Total Bid (B) 10 x Unit Bid Price
Plant one (1) Minimum (1.5) caliper, Bare root tree as specified	10		
Plant one (1) Minimum (2.5) caliper, Balled & Burlap tree as specified	10		
Plant one (1) Minimum caliper/gallon, Container tree as specified	10		

Supply and Plant Specifications

- Quality plant material specification
- Qualification of contractor
 - N.C. Registered Landscape Contractor
 - ISA Certified Arborist
- Storage and handling of trees
- Tree planting specification
- Unit prices for supply and unit price for installation
- Warranty

Supply Only Specifications

- Quality plant material specification
- Packaging
 - Bare Root
 - Containerized
 - Balled & Burlap
- Species, type, size and quantity
- Unit prices for each
- Warranty



3. Planning

Objectives:

- Working with your advisory committee, develop a recovery plan that meets your community budget and wishes.

Preliminary Recovery Budget

Develop a preliminary budget for planning purposes.

- Tree pruning
 - Use your term tree work contract unit prices to assign a cost for each tree and total.
- Tree Removals
 - Use your term tree work contract unit prices to assign a cost for each tree and total.
- Tree planting to replace lost trees
 - Use your tree planting contract unit prices to assign a cost for each tree and total.
 - If you don't have a contract in place, solicit budget estimates from vendors.

Develop Recovery Plan

1. Assemble your advisory committee and begin the planning process utilizing your preliminary budget. Answer the following questions.

- a. Can your community afford the costs to complete the recovery in one year?
- b. Can your community afford the costs to complete the recovery in several years?
- c. Is there supplemental funding available to mitigate the costs to complete the recovery?
- d. Is your unit price tree work contract the most cost-effective methodology to complete the recovery work?

2. Based on your answers, select an implementation schedule that matches your community wishes and budget.

- a. One Year Recovery Plan
 - Option 1 – Complete recovery work with term tree work contract.
 - Option 2 – Solicit lump sum bids for work.
- b. Multi-year Recovery Options
 - Option 1 – Complete the recovery work over three years by management task.
 - Year 1 – Removals
 - Year 2 – Planting
 - Year 3 – Pruning
 - Option 2 – Complete recovery work by management unit.
 - # of years = # of management units
 - Option 3 – Complete recovery work by a combination of management unit and management task to match budget.
 - For example – 5 units x 3 tasks = 15 years

3. Final Recovery Plan

- a. Final Budget
 - Develop final budget based on your implementation schedule.
- b. Implementation Plan
 - Develop an implementation plan detailing the trees to be pruned, removed and planted based on the tree damage inventory.
- c. Public Information Plan
 - Develop a media campaign to inform the community about the details of the recovery plan.



Supplemental Funding Opportunities

- NCFS U&CF Grant Program
 - Consulting, plan development
 - Education and outreach

www.ncforests.gov
- N.C. Urban Forest Council Legacy Tree Fund

www.ncufc.org
- Arbor Day Foundation Grants
 - Tree planting

www.arborday.org
- Create a Local Tree Planting Fund
 - Businesses and individuals readily give to tree planting efforts.

Resources: Storm Damaged Tree Assessment

- N.C. Forest Service Urban & Community Forestry Storm Damaged Tree Assessment BMP

www.ncforestservice.gov/treesandstorms.htm



Percent crown loss, tree health and tree species are variables in the tree removal versus preservation decision.

General Guidance for Trees with Crown Loss around 50%

Remove

- Poor health pre-storm
- Poor location
- Low crown loss tolerant species

Prune

- Good health pre-storm
- Good location
- Higher crown loss tolerant species

Planning and Operations Guidance and Tips

The following details operational information and issues for consideration during your recovery planning and implementation.

Crown Loss: Tree Preservation versus Removal

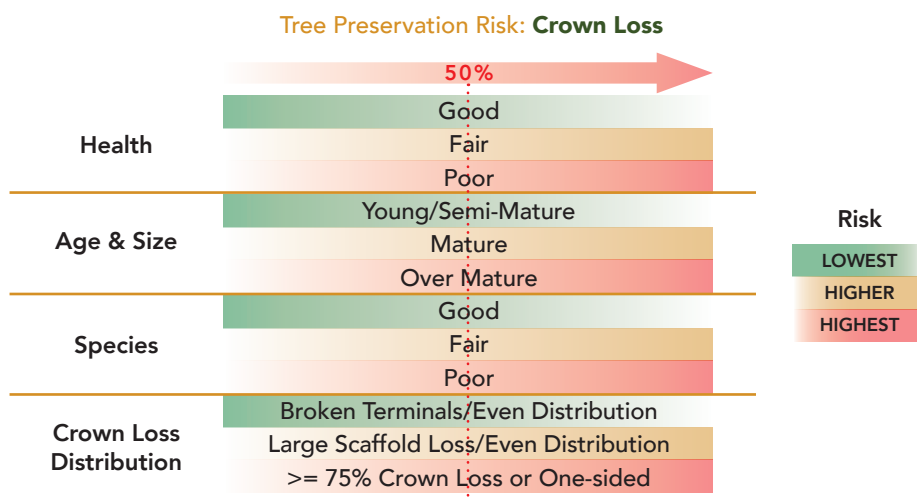
All the hazardous trees have been removed. Is additional tree removal necessary?

You are responsible for the management of your community's public trees. Tree preservation and removal decisions must be made with considering the cost to the community and the health of the whole urban forest. Significantly storm damaged trees are stressed trees. Damaged trees will attract disease and insect pests and will require more maintenance. Storm-damaged trees are also more susceptible to future storm damage. There are risks to preserving trees that have suffered significant live crown loss.

Scrutiny can be applied around the crown loss storm-damage type. A blanket recommendation is to remove a tree that has lost 50% or more of its live crown. What if the crown loss was 49% or 51%? Trees that were healthy before the storm can tolerate more crown loss than trees that were in poor health. Different species of trees can tolerate more crown loss than other tree species. Younger and smaller trees will respond better than older and larger trees. An ISA Certified Arborist should closely evaluate trees with crown loss around this 50% crown loss "rule." The decision of which trees to preserve or remove should be considered within the broader context of forest health and financial risks for the community.

- Biological Risks
 - The trees will decline in health and/or die.
 - The trees will pose a tree health risk to other trees.
- Management Risks
 - There are many storm-damaged trees.
 - The trees will become a safety risk.
 - Storm-damaged trees will be prone to more storm damage in the future.
 - The trees will require regular inspection and pruning and health care treatments.
 - A large percentage of damaged trees will pose a tree health risk to the remaining larger population of trees.
- Financial Risks
 - The trees will require significant expenses for regular inspection and health care treatments.
 - Funding spent on severely damaged trees will not be available to spend on the remaining less damaged trees and tree planting.

The chart below provides a general tree preservation risk after assigning an evaluation of factors that contribute to a tree's ability to overcome live crown loss as part of the NCFS Storm-damaged Tree Assessment BMP.



Tree Planting

Tree Planting Site Specifications

Right tree in the right place is the tree planting rule. Your tree damage inventory has the site data to select the appropriate mature-sized tree species for each site.

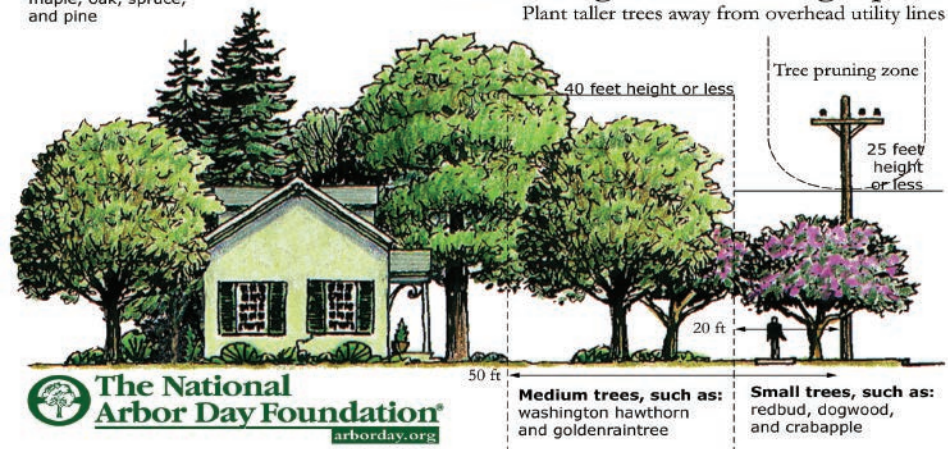
Tree Species Selection

Armed with the tree planting site data, an appropriate tree species can be selected for planting. Work to integrate a diversity of trees species into your tree population and consider wind resistant tree species. Some tree species are more resistant to wind damage than others.

Tall trees, such as:
maple, oak, spruce,
and pine

Plant the right tree in the right place

Plant taller trees away from overhead utility lines



Tree Planting Site Inventory— Good Volunteer Project

If tree planting site data was not collected as part of the tree damage inventory, collect the information. The objective is to collect site features and measurements that would restrict the mature size of tree a site could carry. With clear specification, collecting this data is a great project for volunteers.



Post-Tree Planting Care (Establishment)

- 3-5 years after planting
- Watering
- Mulching
- Pruning
- Contract warranty
- Engage homeowners and volunteers

Trees species for North Carolina with Moderate to High Wind

Resistance (listed alphabetically by botanical name)

Common name	Botanical name
hedge maple	<i>Acer campestre</i>
sugar maple	<i>Acer saccharum</i>
Japanese maple	<i>Acer palmatum</i>
river birch	<i>Betula nigra</i>
musclewood (blue beech)	<i>Carpinus caroliniana</i>
pignut hickory	<i>Carya glabra</i>
mockernut hickory	<i>Carya tomentosa</i>
redbud	<i>Cercis canadensis</i>
common fringetree	<i>Chionanthus virginicus</i>
flowering dogwood	<i>Cornus florida</i>
common persimmon	<i>Diospyrus virginiana</i>
Kentucky coffeetree	<i>Gymnocladus dioica</i>
Dahoon holly	<i>Ilex cassine</i>
American holly	<i>Ilex opaca</i>
Yaupon holly	<i>Ilex vomitoria</i>
junipers	<i>Juniperus spp.</i>
crape myrtle	<i>Lagerstroemia indica</i>
sweet gum	<i>Liquidambar styraciflua</i>
southern magnolia	<i>Magnolia grandiflora</i>
saucer magnolia	<i>Magnolia x soulangiana</i>
sweetbay magnolia	<i>Magnolia virginiana</i>
swamp white oak	<i>Quercus bicolor</i>
live oak	<i>Quercus virginiana</i>
needle palm	<i>Rhapidophyllum hystrix</i>
Sabal palm	<i>Sabal palmetto</i>
pond cypress	<i>Taxodium ascendens</i>
bald cypress	<i>Taxodium distichum</i>

Integrate a diversity of tree species in your tree species selection for planting, community wide and at the street and property level. A large population of a single tree species at any level, is susceptible to high losses due to tree species specific insect pests, disease and even storm damage. Case and point. Pictured here is street lined with severely ice-storm damaged green ash trees the majority of which were removed because of this damage. Green ash is very susceptible to ice storm damage. These ash trees were planted to replace American elm lost to Dutch Elm Disease. Today, ash trees are also the host of Emerald Ash Borer which will kill the tree if regular insecticide treatments are not applied.



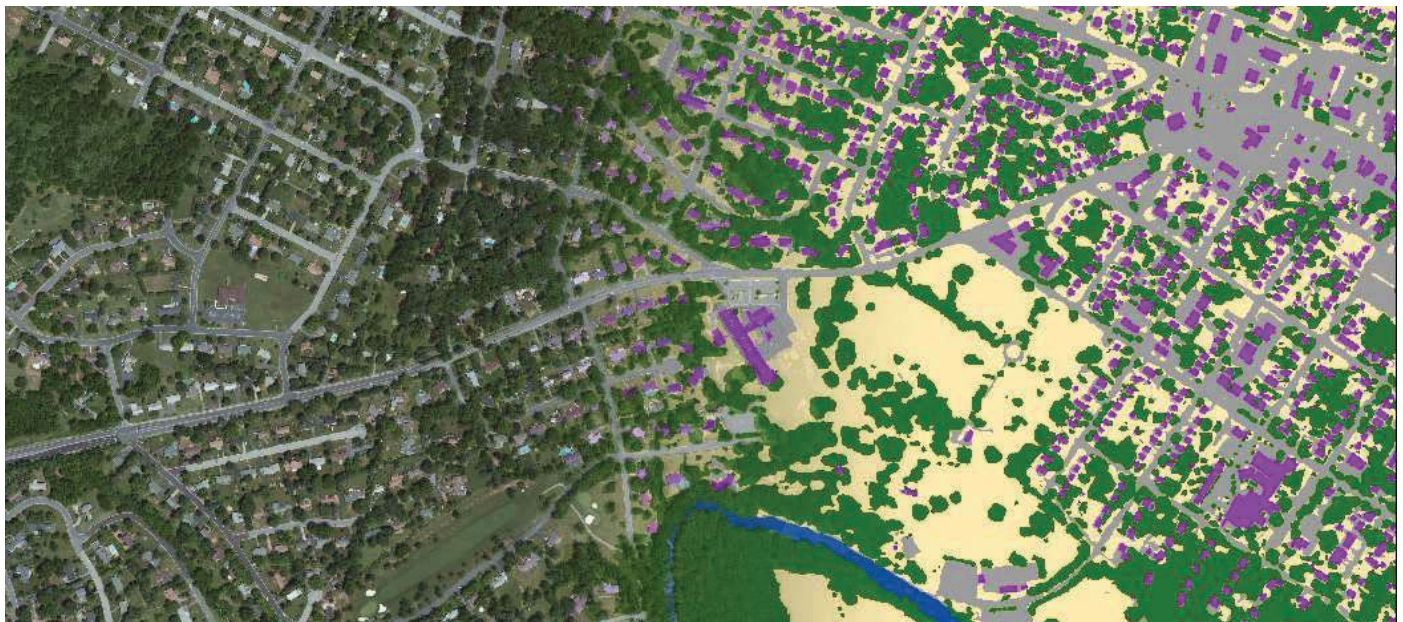
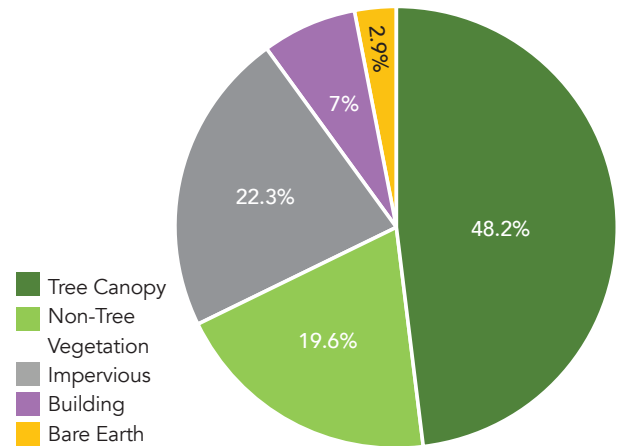
Urban Forest Assessment

Advances in aerial photography, satellite remote sensing and analysis are becoming more affordable to assist with urban forest management and storm recovery. This is largely due to the advances in technology that have increased accessibility to high resolution imagery, the frequency at which new imagery becomes available and the software performing the analyses.

Tree Canopy Cover Assessment

A canopy cover assessment is an analysis of aerial photography and use of other remote sensing methodologies to determine tree canopy cover distribution as well as other land cover data of a community. These assessments are presently used for urban forest management planning and can be used in storm recovery planning. A pre-storm and post-storm assessment will illustrate the impact of large-scale storms on tree canopy cover, quantifying the impact and distribution.

Tree Canopy and Land Cover



A tree canopy cover assessment calculates the percentage of a community covered by tree canopy as well as other land cover types.

Benefits of North Carolina's Urban Trees

- Reduce energy use by \$150M per year.
- Increase shopping by 9-12%.
- Raise property values by up to 15%.
- Reduce storm water runoff by 19-24%.
- Capture 50K tons of air pollutants and 2.1M tons of carbon per year.

Rotational Maintenance Pruning

The urban forest management practice of regular tree maintenance pruning mitigates storm damage. Regular maintenance pruning enhances storm resiliency by pruning structurally weak branches from a tree before they become significant problems. Ideally, all mature trees should be pruned every 5-7 years and young trees every 3 years. A rotation can be established by pruning all the trees in one management unit each year and spreading the cost over 5-7 years.

Storm Damage Mitigation Urban and Community Forestry Program

We have come full circle in the disaster planning process: mitigation, preparation, response and recovery. As this process is a circle, we are back to mitigation and preparation: readiness. Do you have a comprehensive urban and community forestry program? You completed a storm damage mitigation project as part of your readiness planning. You have just worked through a planning process and achieved foundational measures for enhancing your program or formalizing development of a new program. Continue your work mitigating future storm damage and realize the full potential of the services and benefits trees provide to your community by enhancing urban and community forest management in your community.

Set Goals and Objectives

The N.C. Forest Service measures a community's level of urban and community forest management level by using the six measures listed below.

- Annual Arbor Day Celebration
- Community Tree Advisory Committee
- Public Tree Ordinance
- Urban Forestry Budget
- Professional Urban Forestry Staff
- Urban and Community Forestry Management Plan

What steps have you achieved? Achieve the first four, and you can be designated as a Tree City USA. Achieve all six, and you are a North Carolina Managing Community.

Retain Professional Assistance

Contact your local NCFS county ranger, the N.C. Forest Service Urban and Community Forestry branch or an urban forestry consultant.

Learn more at the NCFS urban and community forestry webpages at www.ncforestservice.gov



Young Tree Pruning

Young tree pruning is one of the most important tree management practices. Regular pruning of young trees will prolong tree life and reduce storm damage. It is low-cost and can be completed by volunteers and staff with a little training and simple hand tools.

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