

ASSESSING HURRICANE-DAMAGED TREES AND DECIDING WHAT TO DO



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Introduction

Right after a hurricane, communities and homeowners need to decide what to do with storm-damaged trees. Although damaged trees may seem to be dying, some trees can be restored, others will need to be removed, and still others will not require any special treatment and can be left alone.

The factors that should be considered when deciding whether to remove or restore storm-damaged trees are discussed in detail in this fact sheet. Use this information to help you make an informed decision about how to treat your damaged trees after a storm.

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I. Setting Priorities Immediately after the Storm

Immediately following a storm, trees need to be sorted out into priority groups. We will discuss situations that require immediate attention as well as those that can be treated later.

The most important priority is to determine if the tree poses a safety hazard to humans or animals or is endangering property. Trees become a potential hazard when a target—a structure, vehicle or a person—could be struck by a falling tree or any of its parts. Therefore, a hazard tree is any tree that if it falls would result in damage to property, people or other valuable trees.

QUICK GUIDE

Trees That Do Require Immediate Attention



Figure 1

This tree requires urgent attention because it is leaning on power lines. Trees or branches hanging over power lines are also of immediate concern.

Figure 2

Trees or parts of trees that are blocking driveways or roads need to be taken care of as quickly as possible.

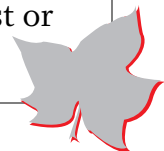
Figure 3

Damaged trees in public places and highly trafficked areas, such as this parking lot, are of immediate concern. The broken limbs hanging above the ground are hazardous to cars and pedestrians.

! Immediate Attention

The situations depicted in these photos are highly dangerous and should be taken care of immediately. The trees shown in Figures 1 and 2 need to be removed, while the tree in Figure 3 needs to be pruned as soon as possible.

In these situations, the work should be performed by a certified arborist or properly trained professional.



QUICK GUIDE

Trees That Do Not Require Immediate Attention



Figure 4
Since there is no target, this tree can be removed later.

Figure 5
This tree can be removed later since it is not blocking any thoroughfare.

Figure 6
This tree can be treated later since it is not located in a highly trafficked area and does not pose an immediate threat.



Follow-Up

Keep in mind that many trees can be saved with appropriate treatment. There is no need to rush out and remove trees that do not pose an immediate safety hazard. Trees can recover from substantial damage, and what looks awful at first may be judged as much less serious by an experienced professional.



Who Should Clean Up after the Storm?

Now that we have discussed setting up priorities, it is important to get the right tree care professional for the job. Homeowners should not attempt to do all the work themselves, like the man in Figure 7.

Certain situations require advanced training and are best handled by arborists certified by the International Society of Arboriculture (ISA). These include removing a leaning tree or broken limb near a house or other target, restoring a damaged tree that could be saved, evaluating a tree hazard potential, reaching limbs that require climbing and pruning. Likewise, only qualified line-clearance arborists should work near electrical utilities. Call the power company to report tree limbs that have fallen on or are hanging over a power line.

Keep in mind that storm damage cleanup is extremely dangerous, even for professionals. Numerous injuries and deaths occur during cleanup after storms. When working with trees in the aftermath of a hurricane, it is essential to look up, down and around. Beware of dangerous broken limbs that are hanging or caught in other branches overhead and may fall. Safety should be a priority.

FOR MORE INFORMATION »		
ON SAFETY	CH 1	Cleaning Up after a Hurricane: Safety Comes First!
ON HOW TO HIRE A TREE-CARE PROFESSIONAL	CH 2	Getting the Right Tree Care Professional



Figure 7

Chain saw use should be left to the professionals. If homeowners decide to use a chain saw, they should only work on the ground and with proper protective equipment. What is wrong with this picture?

Not All Trees Need to Be Cut Down!

A common reaction after a wind storm is to remove all trees to avoid future problems (Figure 8), especially if a tree has fallen on a home or other valued property. However, not every tree poses a high risk. Unfortunately, few communities and decision-makers realize that the benefits of trees in the urban forest in the long term far outweigh the costs needed to pay arborists to care for trees.

It has been observed that a grouping of well-placed, healthy trees may actually help redirect winds and serve as a protective barrier for homes (Figure 9). Communities with a well-maintained urban forest may suffer less damage after hurricanes than those without maintenance. Having an active management program reduces the losses from winds and establishes a restoration plan when damage does occur.

FOR MORE INFORMATION »		
ON DEVELOPING A TREE-CARE PLAN	CH 14	Developing an Urban Forest Management Plan for Hurricane-Prone Communities



8



9

Figure 8

A common reaction after hurricanes is the removal of all the trees to avoid future problems.

Figure 9

A healthy urban forest with well-placed and well-maintained trees may redirect winds.

II. Factors to Consider When Deciding Whether to Remove or Restore a Tree

After all the safety concerns have been addressed, the most difficult part of responding to a storm is deciding which damaged trees should be pruned back to health and which trees should be removed. The eight items below are interrelated and together will help you determine the amount of care a tree will need after a storm. They will guide the decision of what trees should be removed and which ones can be restored.

a	Amount of Damage	p. 5
b	Tree Size and Age	p. 5
c	Tree Species	p. 6
d	Tree Health	p. 7
e	Tree Structure	p. 8
f	Previous Cultural Practices	p. 9
g	Site Conditions	p. 9
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a. Amount of Damage

Trees with more damage will require more work than those with less damage.

What parts of the tree were affected, how much of the canopy is gone and how big the wounds are will determine the amount of care needed. The larger the wound is in relation to the size of the limb, the more vulnerable the tree is to decay, diseases and pests (Figures 10 and 11).

b. Tree Size and Age

Younger and smaller trees will take less time to restore than more mature and larger trees.

Younger and smaller trees survive winds better and suffer less damage than older trees, making them better candidates for restoration pruning (Figure 12).

On the other hand, older, more mature trees may have accumulated multiple defects (e.g., bark inclusions, cracks, and extensive decay) over the years, often making them very susceptible to damage in storms.



Figure 10

This tree is only defoliated with a few broken branches. The only action that needs to be taken is to prune its broken branches.



Figure 11

If over half of the canopy is gone (including the main leader) with several broken stems, the tree should be cut down.



Figure 12

This small tree sustained damage but because it is young it can be pruned over the next few years to help it recover.

c. Tree Species

Trees that resist decay are better candidates for restoration than those prone to decay.

Trees that resist the spread of decay into their wood are called good compartmentalizers, and are more easily restorable. Examples include live oak (*Quercus virginiana*), mahogany (*Swietenia mahogani*), false tamarind (*Lysiloma latisiliquum*), winged elm (*Ulmus alata*) and buttonwood (*Conocarpus erectus*) (Figure 13).

On the other hand, poor compartmentalizers are trees prone to decay, such as African tuliptree (*Spathodea campanulata*), Hong-Kong orchid (*Bauhinia blakeana*), redbay (*Persea borbonia*), laurel oak (*Quercus laurifolia*) and water oak (*Quercus nigra*) (Figure 14). These species may be problem urban trees since large pruning cuts, trunk injuries and root damage can result in hollows and extensive internal decay in their roots and trunks.

FOR A LIST OF	
GOOD AND POOR COMPARTMENTALIZERS	http://hort.ifas.ufl.edu/woody/compartimentalization.html



Figure 13

Buttonwood is an example of a good compartmentalizer.



Figure 14

Water oak is an example of a poor compartmentalizer.

Short-lived species may not be worth restoring.

Every tree species has an inherent life span and some tree species live longer than others do.

Longevity should be considered when evaluating whether a tree is worth restoring or should be removed (Figure 15). Usually short-lived trees also do not compartmentalize decay well. Keep in mind that risk of failure increases with age.



Figure 15

The laurel oak lives up to about 50 years and begins to decay as it reaches 40 years old. The laurel oak in this photo is now 45 years old and suffered moderate to extensive wind damage. Is it worth restoring this tree or should it be replaced? It is probably more cost-effective to plant another species in its place.

Table 1. Life span of some species in the forest *

Short-lived (< 50 years old)	Medium-lived (50-100 years old)	Long-lived (> 100 years old)
laurel oak	African tuliptree	live oak
red bud (<i>Cercis canadensis</i>)	paradise tree (<i>Simarouba glauca</i>)	sweetgum (<i>Liquidambar styraciflua</i>)
bottle brush (<i>Callistemon</i> spp.)	red maple (<i>Acer rubrum</i>)	southern magnolia (<i>Magnolia grandifolia</i>)
Hong-Kong orchid tree	gumbo limbo (<i>Bursera simarouba</i>)	baldcypress (<i>Taxodium distichum</i>)
jacaranda (<i>Jacaranda mimosifolia</i>)	sea grape (<i>Coccoloba uvifera</i>)	mahogany

* Note that urban trees have a shorter life span.

d. Tree Health

Healthy trees will recover better after storms than unhealthy ones.

Decay, a major cause of tree failure, is caused by fungi that weaken wood as they grow. Cracks, seams, butt swell, cankers, dead branch stubs and large, older wounds suggest internal decay and increase the likelihood of tree failure in wind. Decay is often present without obvious signs (Figures 16 and 17).

Mushrooms at the base of the tree trunk can be the sign of *Armillaria* or other fungi that can decay roots and create unstable trees (Figure 18). Root rot (Figure 19) can be identified with careful, regular inspections by accomplished arborists.

Did you know?

Decay is often present without obvious signs, but can be identified with careful, regular inspections by accomplished arborists.



Figure 16

Before the storm: this tree appeared intact.



Figure 17

After the storm: the tree turned out to be hollow.



Figure 18

Before the storm: presence of *Armillaria*.



Figure 19

After the storm: extensive root rot contributed to this tree toppling over.

e. Tree Structure

Trees with good remaining tree structure are worth saving and will be more easily restored.

One trunk up through the canopy, branches considerably smaller in diameter than the trunk, evenly spaced branches, balanced canopies, absence of codominant stems and bark inclusions are all signs of a strong tree. These characteristics make trees better able to resist storms (Figure 20). Certified arborists are able to create and maintain such strong structure by appropriate pruning techniques, especially if they begin early in the tree's life.



Figure 20

This tree has a strong structure and it is a good candidate for restoring. There are four evenly spaced branches, smaller in diameter than the trunk.

FOR MORE INFORMATION »	
ON TREE STRUCTURE	CH 12 Developing a Preventive Pruning Program in Your Community: Young Trees
	CH 18 Developing a Preventive Pruning Program in Your Community: Mature Trees

f. Previous Cultural Practices

Poor pruning practices make trees susceptible to failure and breakage.

Removing large branches results in large pruning cuts that can serve as entry points for fungi that begin the decay process (Figure 21). Topping is also a poor pruning practice that should be avoided. Sprouts that grow from topped trees are poorly connected to the cut stub, making them susceptible to breakage in storms (Figure 22).



Figure 21

A large pruning cut several years ago caused decay and created a weak spot where the tree eventually broke.



Figure 22

This tree was topped a year ago and the several sprouts that grew from the cut stem broke in the wind.

Poor root management practices will affect tree stability.

The importance of root integrity and health cannot be overemphasized. In addition to absorbing water and essential elements, roots anchor the tree. If roots are damaged in any way, the likelihood of failure increases (Figure 23). Construction activities within about 20 feet of the trunks of existing trees can cause the trees to blow over more than a decade later.



Figure 23
Construction is especially damaging to roots, such as these roots cut during curb repair.

g. Site Conditions

Trees need adequate soil space and good soil properties to be stable.

Trees with root systems confined to relatively small soil spaces are not as stable as trees allowed to develop more extensive root systems (Figure 24).



Figure 24
These roots were deflected by the curb and the compacted soil, making them very susceptible to blowing over in the direction away from the curb.

Soil compaction, shallow soils, hardpans and a high water table restrict roots to shallow depths and can result in unstable trees (Figure 25).



Figure 25
The high water table at this site restricted root depth and saturated soil allowed roots to slide in the soil, making these pines topple over during a hurricane.

Poorly located and/or chosen tree species may not be worth restoring.

The importance of selecting the right tree for the right location has been greatly stressed, and yet selection of inappropriate trees is one of the most common mistakes observed. For example, the white oak (*Quercus alba*) in Figure 26, which can grow to 100 feet and will develop wide-spreading crowns and numerous horizontal branches.



Figure 26
These white oak roots were confined by the buildings around them, probably damaged by construction and compaction, resulting in a root system too small to support such a large tree canopy.

If the tree is in the wrong location (such as a tall tree beneath a power line), or if it is an undesirable species for the property (messy fruit, not drought-tolerant, etc.), it may be best to remove it if the tree sustained serious damage.

h. Cultural Value

How valuable the tree is to you and the community will determine the amount of restoration effort needed.

In addition to the economical value and ecological services that trees provide to the owner and community, the tree in question might be a memorial tree, or it may have a historical significance or some other cultural attribute associated with it (Figure 27).



Figure 27
This live oak is part of a historical 1900s hotel, as shown by the owner, located in the Bagdad Village Historic District, Milton, FL.

III. When to Remove a Tree

In general terms, these are the situations when a tree requires removal after safety concerns have been addressed. Remember, the priority is to remove trees that represent a hazard to people and property.

1. The lower main trunk is cracked or broken

Trees with cracks in the main trunk and branches are very dangerous, since limbs with this type of damage are not well-secured to the tree. Cracks well into the trunk (Figure 28) will not close and represent a severe defect that makes such trees a high risk in the landscape.



Figure 28
This tree should be removed since its broken stem is very large and the trunk is cracked, as shown by the circle. If the tree were not cracked into the trunk, the broken limb could be carefully removed and the tree might be restorable.

2. A large stem has split from the tree

Figure 29 shows a tree that needs to be removed because of the large codominant stem that split from the trunk. Notice the dark area at the top of the split—it is a bark inclusion (Figure 29). Bark inclusions are weak unions between branches and are very susceptible to breakage.



Figure 29
The circle shows a bark inclusion which broke during a tropical storm. The tree should be removed.

3. The tree is leaning towards a target

If a leaning tree is likely to fall on a person, building, power line, roadway or other valuable target, it should be removed immediately after the storm. However, *all* leaning trees should have their roots carefully examined for breakage, exposure or lifting out of the soil (Figure 30). Pay close attention to leaning trees with unbalanced canopies, cracks in the trunk and bark inclusions.



Figure 30
This leaning tree needs to be removed since major structural roots were broken and lifted.

4. The remaining tree structure is highly susceptible to breakage

The tree shown in Figure 31 should be removed! It suffered major structural damage and the remaining tree structure is compromised. All the mass is on one side of the tree, and the trunk is very weak because of the two splits. The cause of both splits was a bark inclusion.



Figure 31
One split occurred 8 years ago (lower injury) and one occurred about 2 weeks before this photo was taken. The tree should be removed.

5. The major roots are severed or broken

Fallen or leaning medium-aged and mature trees usually suffer severe major root breakage. Once cut or broken, these roots will not reconnect well into the soil and are unlikely to develop the root structure needed to keep the tree erect (Figure 32). The reason for that seems to be that severed large-diameter roots do not regenerate new roots as well as small-diameter roots (one-inch-diameter or less). Also, large broken roots can decay or rot, making the tree unstable (Figure 33).



Figure 32

Medium-aged and mature trees should not be re-staked if they have failed at the roots. Large trees need large roots for structural support.

6. Large limbs are broken

Remove trees with most of the canopy damaged due to large-diameter (greater than 8 inches) branch breakage (Figure 34). Trees with small-diameter broken branches have a better future and can be restored (Figure 35).



Figure 33

Roots on this tree were rotted, so they will not generate new roots.

7. Girdling roots are causing dead spots and cracks in the trunk

Roots circling the trunk are often referred to as girdling roots, and tree death could occur when the root encircles most of the trunk (Figure 36). Trees with circling roots and cracks in the trunk will be less stable than trees without these characteristics and should be removed.



34



35

Figure 34

This tree needs to be removed.

Figure 35

This tree can be restored.

Remember:

If you remove a tree, plant another one in its place!



36

Figure 36

These roots are circling around the trunk and crossing other major roots, causing trunk dead spots and cracks.

IV. When to Restore a Tree

Even after experiencing high winds, many trees can be restored. However, only restore trees with major limbs, trunk and roots intact (Figures 37 and 38). To be a good candidate for restoration, a tree should have no cracks in major limbs or the trunk, no decayed wood, and no bark inclusions. Roots should not be exposed, lifted out of the soil, or girdle around the trunk. Make sure the branch and trunk structures were good prior to the storms.

These are general guidelines that will explain in detail when a tree should undergo restoration pruning:

1. Trees are young

Young trees less than 10 inches in diameter, such as this live oak (Figure 39), make good candidates to restore because there are fewer branches to prune, the canopy is closer to the ground, and they can tolerate having more of their canopy removed than older trees.

2. The canopy is defoliated

Trees that lose their leaves in a hurricane usually are not dead. Many trees generate new foliage in the weeks following the storm*. Research has shown that for some species, such as gumbo limbo and live oak (Figure 40), defoliation is usually a strategy for survival since it reduces wind resistance. Defoliated trees that were healthy before the storm with no major branch breakage require no special treatment. Wait. Time is the best treatment for this type of damage. There is no need to apply fertilizer or other chemicals.

Trees and palms that were inundated with salt water often lose leaves due to root damage. In this case, trees need to be irrigated to wash salts through the soil.



Figure 37

This tree is restorable. It has one stem well up into the canopy with no codominant stems, well-spaced limbs, and no bark inclusions. Its roots are well-distributed around the trunk, and there are no girdling roots.



Figure 38

Restoration is difficult for this tree because of its poor initial structure. This young 20-year-old multi-trunk live oak has codominant stems with bark inclusions that will be a real challenge to fix.



Figure 39

Younger trees survive winds better and suffer less damage than older trees because they are easier to prune and maintain.



Figure 40

Live oak loses most of its leaves during a wind storm.

*Note: Some species, such as pines, may not recover their foliage after hurricanes. See Pines (page 16) for more information.

Many new sprouts will eventually emerge on hurricane-damaged trees. Some trees wait to produce new foliage the following spring. Sprouts should be allowed to grow because they provide the energy the tree will need to recover (Figure 41) and they can be pruned later.

FOR MORE INFORMATION »	
ON SPROUT MANAGEMENT	CH 4 Restoring Trees after a Hurricane

3. Small branches are broken or dead

Trees with small broken or dead branches (less than 4 inches diameter) can easily be pruned from the canopy and have a good chance of recovering. Trees with small branches have a better chance of recovering than large-diameter branches (greater than 8 inches diameter). If small, codominant stems are broken in the upper canopy without damage to the main trunk, the tree can also be restored (Figure 42).

4. Most of the canopy is damaged in decay-resistant species

Trees that resist decay well can lose much of their canopy and still recover from a storm. Even with $\frac{3}{4}$ of their small branches (less than 4 inches diameter) broken or removed by a hurricane, many decay-resistant trees can be restored (Figure 43).

5. Some major limbs are broken in decay-resistant species

Many species good at resisting decay after they are wounded can be restored even with some major branch breakage (Figure 44).



Figure 41

Managing sprouts over time can create reasonably good structure and a nice looking tree canopy. Sprout management should be carried out by professional arborists.

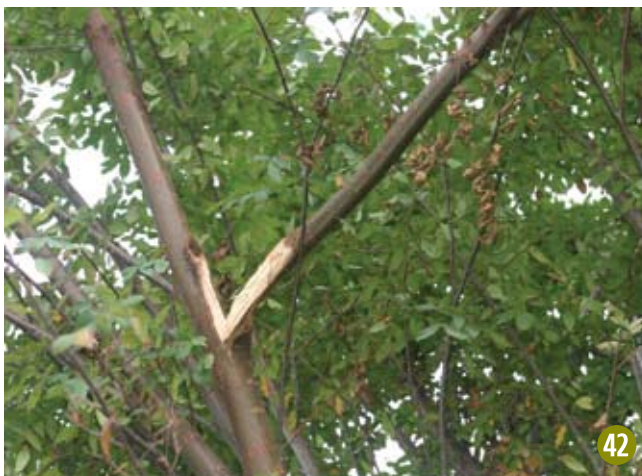


Figure 42

To remove a small branch, cut at the base of the tear or remove the entire damaged branch if it is not the main trunk.



Figure 43

Mahogany can be restored even with some major branch damage.



Figure 44

This decay-resistant tree can be restored even though it lost most of its canopy foliage.

6. Leaning or fallen trees are small or recently planted

Trees that have a trunk diameter smaller than 4 inches should be stood up as quickly as possible to prevent roots from drying out (Figure 45). Such small trees have a better chance of developing the proper root structure to keep them firm in the soil than bigger trees.

Recently planted trees can be uprighted at any size because they usually do not have large broken roots (Figure 46). These trees should be treated as a new planting and staked with the help of a professional.

FOR MORE INFORMATION »	
ON HOW TO STAND, STAKE, AND IRRIGATE FALLEN TREES	CH 4 Restoring Trees after a Hurricane



Figure 45 This leaning elm (*Ulmus spp.*) could be stood up and staked.



Figure 46 Recently planted trees, such as this red maple, should be treated as a new planting by staking and watering properly.

What Tree Size Can Be Uprighted?

Experienced arborists who have stood trees up after storms are finding that those greater than 4 inches trunk diameter are more susceptible to falling over in subsequent storms than smaller trees. The reason for this appears to be due to lack of generation of new roots on large severed roots when compared to regeneration on small roots (one inch diameter or less). Also, large severed roots can decay or rot more easily.

Table 2 shows general basic guidelines based on arborists' and other tree professionals' observations. Keep in mind, however, that there is no published research or definitive answers on this topic yet.

Table 2. Guidelines for standing up trees based on trunk diameter.

Trunk diameter	Action
Less than 4 inches	Stand up and stake
From 4 inches to 8 inches	Maybe stand up and stake Could be a hazard later
More than 8 inches	Not recommended Likely to be a hazard later

Look for Circling Roots in Small Leaning or Downed Trees

Before deciding whether to stand small leaning or downed trees up, look for the presence of circling roots. Some circling roots can be removed and the tree will respond with increased vigor (Figure 47). Other trees will need to be removed (Figure 48). If roots circle around most of the tree trunk, the tree is not restorable because girdling roots inhibit secondary growth and the movement of water and photosynthates.



Figure 47

This tree can be restored since it only has one root circling the trunk. Before uprighting the tree, cut the circling root at the point just before it begins to circle, as indicated by the dotted line. This will allow new roots to grow away from the trunk, thus increasing the likelihood the tree will regain support.



Figure 48

This tree should be removed. Too much of the root system originates from the roots that are circling the trunk, making treatment impractical.

V. Assessing Pines

Pines are very sensitive to wind damage. Pines can snap, uproot or lean after storms. A pine still standing after a hurricane may have internal damage that is not visible. Before making a decision to remove or restore, wait and see if the tree lives, considering these points:

- Pines often die over a period of 6 months to 2 years after wind storms.
- Some may remain green for a year or even longer, then suddenly turn yellow (Figure 49) and progress to brown needles in a very short period.
- Pines with all brown needles are dead and should be removed.
- Monitor pines carefully for insects. Weakened pines may be more susceptible to beetles and diseases.

What causes yellowing of the needles and pine death?

The causes are not completely understood, but it is likely due to hidden damage produced by bending and twisting the trunk during hurricane-force winds. Prolonged winds may also rupture smaller roots without breaking the larger support roots. The injured stems and roots are unable to supply the water and nutrients needed in the crown, resulting in yellow needles and decline.



Figure 49

Six months after a hurricane, this pine has suddenly turned yellow and may die.

VI. Assessing Palms

Palms grow differently from other trees. The growing point of a palm is at the top of each trunk, surrounded by leaves (fronds). All fronds originate from this one point (bud). If the bud is severely damaged or killed, new leaves fail to develop and single-stemmed palms will die. On multi-stemmed palms, the undamaged trunks could recover if their buds are not damaged. If the trunk is snapped in half, the palm is dead. However, for palms left standing, the bud is often not accessible, making it difficult to determine whether it is damaged. For these palms, follow these guidelines:

- Allow at least 6 months for palms to put out new growth. New leaves may be stunted, discolored or abnormally shaped.
- It may take 1 to 2 years or more before palms appear normal with a full canopy.
- Irrigate 3 times a week for 6 weeks if there is not sufficient rainfall; longer if drought persists.



Figure 50

The royal palms (*Roystonea elata*) circled in the back are dead since their buds are clearly destroyed. The palms in the front, however, can be restored by simply allowing them to grow.

Recovery from a storm is not a quick process, so have patience with your palms.

Final Considerations

Right after a storm it is important to sort out trees into priority groups, acting immediately in situations that require urgent attention and selecting trees to be monitored and treated later on. Remember that even though hurricanes can be devastating to communities and urban forests, not all storm-damaged trees need to be removed and many trees can be treated and saved.

When assessing damage, think about it in terms of tree function and your objectives. Management actions will depend on observing the interrelated points below when deciding what trees to remove or restore:

- Soil space and soil properties
- Tree health, size and age
- Previous cultural practices
- Previous tree structure
- Amount of damage

Always observe safety procedures. Storm damage cleanup is extremely dangerous, even for professionals. Hire a certified professional to help with post-hurricane recovery and to implement a restoration pruning program.

FOR MORE INFORMATION »	
ON PROPER RESTORATION TECHNIQUES	CH 4 Restoring Trees after a Hurricane
ON HOW TO IMPLEMENT A RESTORATION PRUNING PROGRAM	

Suggested Reading

Duryea, M.L., E. Kampf, and R. C. Littell. 2007. Hurricanes and the Urban Forest: I. Effects on Southeastern United States Coastal Plain Tree Species. *Arbor. & Urban Forestry*, 33(2):83-97

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Additional Resources

Trees and Hurricanes

<http://treesandhurricanes.ifas.ufl.edu/>

International Society of Arboriculture (ISA)

<http://www.isa-arbor.com/>

Florida AgSafe

<http://www.flagsafe.ufl.edu/>

Urban Forestry South Expo

<http://www.urbanforestrysouth.org/>

USDA Center for Urban Forest Research

<http://www.fs.fed.us/psw/programs/cufr/>

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