

HURRICANE IRMA CULLS THE URBAN FORESTS OF FLORIDA

Submitted by John Harris, President –Earth Advisors, Inc.

During the storm recovery period after Hurricane Irma, we observed the need to remove many trees. We were constantly asked, “What caused my tree to fail?”

The easy answers many people say and hear are:

1. The winds were strong enough to uproot the tree (the roots were too damaged to reset it).
2. The winds came through and tore up leaders and branches destroying the tree.
3. The constant tropical storm and hurricane level winds, over 1-2 days, dried out and tore off too many leaves and branches for the tree to recover.

Those generalizations are often misleading about tree hazards and why trees fail during storms. There is a strong correlation between tree failures during the storm and the lack of proper tree care (history/ maintenance) before a storm’s arrival. Trees with poor maintenance histories were the majority of uprooted or severely damaged trees in Hurricane Irma. Poorly placed, poorly maintained, and unmaintained trees are more susceptible to failure.

Hurricane Irma culled our urban forests of weaker trees. I have inspected thousands of trees across Florida from the Keys through to central Florida since Hurricane Irma’s wind receded. I also have interviewed many professional foresters, arborists, landscape inspectors, landscape contractors, and others, to learn from their observations of why trees failed. Green industry meetings



Mahogany tree with internal decay, and close angled main stems, damaged the house. Also, a Ficus seedling had started growing in the decay area, causing more outward pressure. These are the reasons this tree failed in the winds; not just that there was wind.



Ficus growing in +/- 5' wide street swale, with road rock base across greenspace under root system. Winds uprooted tree due to lack of soil needed for root growth and anchor depth.

are happening month by month, in different regions of Florida, and sharing observations of what happened across our landscapes and inside our urban forests. Discussions are being held to find out how we are doing with storm recovery and cleanup; and to explore how we can improve our practices and reduce the loss of trees and landscape plants in future storms.

Why do I say the storm culled our urban forests? Culling is the removal or separation of weaker individuals from a population. It is a forestry management practice used to improve the growth and quality of trees within a stand. The term cull is also used in the Florida Grades & Standards as the lowest quality for a plant being graded-- “Cull quality.” Generally, due to their poor structure and non-saleable condition, cull quality plants would be chipped, or composted, to provide the recycled nutrients for plants that meet the quality standards for sale.

You may think the quality of the trees and past maintenance may not make much difference for locations that experienced the strongest winds, the highest tidal surges,

and/or prolonged flooding. I say quality and maintenance did still make a difference, even in these locations. Certainly, where tornados speed through, where downdrafts and hurricane force winds bear down, where 4-8' of salt water surges in, trees, plants, vehicles, and buildings will receive an increase in the level of damages. Even in the areas hit hardest by Hurricane Irma, the trees that were better rooted, consistent aspect ratios (proportional relationship between a tree’s height & width), tapered limbs throughout their canopies, and were species known to be more wind resistant, experienced less damage -- contributing less to the destruction and debris piles.

There are many wind factors and site conditions that influence the level of damages for a particular location. Discussing them is for another longer article that includes discussing and summarizing from research projects that study hurricanes and urban forests. University of Florida research projects, up through Hurricane Wilma, are well summarized in the bulletin “Assessing Damage and Restoring Trees after a Hurricane,” University of Florida/IFAS Extension,

continues on pg. 6



Java Plum trees that show previous hatracking (stub cutting of most or all main leaders), shown by the darker bark below old stub cuts (+/- 10 years ago) and the lighter gray bark and multiple sprouts growing above old stub cuts. All the trees in this median were stable for main trunk and root system, but the sprouts broke apart severely in winds. This is why hatracking is a violation of many city codes and industry standards---it is an abuse that causes trees to be structurally weaker and more prone to branch failure in wind storms.

Bulletin ENH1036. This bulletin is part of the larger Urban Forest Hurricane Recovery Program, and more information can be read at <http://collier.ifas.ufl.edu>.

Preventative maintenance is an investment strategy that applies to almost everything we see around us. Most people understand that maintenance is needed for many parts of our urban environment. Roads or pavement, as it ages, can break up with potholes that become larger if left unrepaired. Aging roofs begin to have leaks that continue to get worse until repaired. Cars need regular maintenance (changing the oil every 5,000 miles or so, changing tires before they wear down past the treads, etc.) to keep them operating. With regular maintenance, aging trees can provide greater benefits, fewer risks, and are healthier.

Here are some of the more visible and maintainable examples of why trees failed and were culled out of our urban forests by Hurricane Irma:

1. Girdling roots at the location where a tree trunk snapped and failed.
2. Circling roots around the outside of a root mass (root balls). Trees did not develop the spreading roots needed to increase soil volume to anchoring roots. Uprooted trees often displayed the entire root systems. A system of stunted roots that could have fit back into the same size nursery containers they were in when first planted.
3. Restricted rooting space that hampered the growth and extent of root masses, leaving large trees without enough ballast in the ground to stay in place during high winds. Trees fell showing the restricted root growth in the uprooted root masses.
4. Shallow soil conditions, as observed in development sites where road rock base for pavement and foundations is not removed from greenspace areas. Trees mainly grew surface roots and shallow anchoring roots. Trees uprooted with a "pancake" of roots exposed.
5. Old stub cuts, or "hatrack," along a leader or main limb where branches tore or broke off.
6. Tight angled branch junctures (or trunk junctures) with included bark and/or signs of pressure between the trunks



Cutting all the live foliage and secondary branches out of your tree, IS TREE ABUSE; IS HATRACKING. Here you see a large hat rack; instead of the canopy tree that used to exist. Now, we have a tree needing code enforcement, removal, and replacement instead of restoration pruning and preservation.

- or branches that tore apart when winds blew through the canopy.
7. Trees with most or all live canopy in the upper 1/3 or 1/4 of the tree height, without the anchoring and support of lower limbs and having less tapering of leaders and limbs. The winds whipped the high canopies and tore the limbs and leaders out of them.

Each of these examples is a defect or deficiency that can be identified during the life of a tree. Each can be corrected by preventative maintenance and proper tree care practices or by culling the tree before it is placed in the landscape. One consistent theme comes from the workshops and seminars and meetings and discussions I have attended since Hurricane Irma: "We need to get the word out. Maintained trees survive storms better, trees require maintenance, and tree damage can be prevented."

Help the Florida Urban Forestry Council get the word out about proper tree care. Well-maintained trees will provide greater benefits. A resilient tree canopy will buffer communities during storms by protecting homes, businesses, and properties from damage. Read more about trees and hurricanes from the great research that has been done and is being planned to continue after Hurricane Irma. Use the research to update your municipal and county tree protection and landscape codes. Lastly, share your hurricane and disaster experiences when attending upcoming meetings, seminars, and workshops. What did you see regarding tree survival and tree failure? What do you know about standing and/or uprooting trees? Your observations can help to generate new standards, new codes, and new practices that will improve our shared environment.

Thanks to everyone for your efforts during our Hurricane Irma Storm Recovery time together. Continue to work smart and be safe. Let people know trees saved more homes than they damaged. The urban forest provides a level of storm protection for our communities. We look forward to working with you for a better shared environment.

- John A. Harris, FUFC President; MS, MBA, BS, AAS; Landscape Economist; Tree and Landscape Appraiser; Certified Forester; Registered Consulting Arborist; Certified Arborist; Certified Landscape Inspector; Tree Grader; Registered Professional Mangrove Trimmer; and Qualified Tree Risk Assessor

STUMP THE FORESTER

QUESTION: What impact will storm flooding have on street trees?

ANSWER: Though flooding will have an impact on our urban trees, the beneficial impact trees will have against the detrimental impacts of excessive storm water cannot be over-emphasized. Storm-related flooding accounts for the majority of polluted runoff to surface water, property damages, and storm hazards to public safety. Trees, and a resilient urban tree canopy, will ultimately play an important role toward a greener storm water solution, and a viable action plan.

Street trees may be able to withstand temporary periods of stress caused by storm flooding, but flood waters can deplete the soil of oxygen and create the anaerobic conditions that suffocate roots – halting the biological functions of photosynthesis, transpiration, and plant respiration. When talking about trees, leaves and photosynthesis get a lot of attention. Respiration is often overlooked. Respiration is the process by which stored carbohydrates, produced through photosynthesis, are used by the tree. Trees are incapable of respiration in the absence of free oxygen to roots. If flooding depletes the soil of oxygen for long periods of time,

roots will decline, or die. Flood waters can also dilute essential elements and build up mineral toxicities within the soil. This is especially true if the flooding involves brackish, or salt water.

Flood-stressed trees may turn brown, or drop leaves prematurely. This does not mean that a tree is dead. If the cambium layer- just under the bark – is green and alive, the tree will likely recover.

Though storm flooding is often a temporary condition, the detrimental impacts on a tree's anchoring system can be significant and immediate. Evidence reveals a direct correlation between increased soil saturation and tree-related power outages associated with hurricanes and severe storms. Soil

moisture data from NASA's Soil Moisture Active Passive (SMAP) satellite maps have been used to forecast tree-related power outages with a surprisingly high degree of accuracy. This is no surprise to what we've seen on the ground. Increased soil saturation, caused by flooding, will decrease the holding capacity between roots and soil. The results can impact the anchoring system for weeks, or perhaps months after the storm. The structural integrity of the root system should not be overlooked when inspecting trees that survived flooding.

Answer provided by Joe Anderson, Utility Forester with JEA



If you would like to 'stump the forester,' see page 15 for information on submitting your question!

AVOID THE CRASH

Submitted by Dave Conser, Senior Forester, Florida Forest Service



CRASH! She was sure a car had run into her house and went rushing outside to find, not a car, but a huge tree branch, splayed across the roof. With all the soaking rains a large, dead branch had finally given into gravity. Why hadn't someone seen that ahead of time and done something about it?

When Hurricane season is upon us, some homeowners turn their attention to the condition of their trees. Others are blissfully unaware of the hazard that may be lurking above. Should we turn our yards into treeless pastures, or throw our hands up in resignation of ignorance? Neither extreme is necessary or appropriate.

There are tried and true principles when assessing the hazards a particular tree may possess. Granted, there are few guarantees regarding what this natural world may or may not throw our way. But the following are some principles I have gleaned through years of advising homeowners regarding the condition of their trees.

Sick, stressed or compromised trees often show signs to the discerning eye. Not in every case, but often enough if we pay attention. A tree with a full, luxurious canopy of leaves is almost always more healthy than one with a thinning top. Foresters and arborists call the live top of a tree its "crown." Crown decline refers to a condition when a tree has a significant number of leafless twigs scattered throughout the top of the tree. It signals that the tree is declining, often due to root injury and/or the steady progression of one or more root diseases. A tree with compromised roots is more likely to topple over, possibly onto something important.

The trunk and branching structure of a tree is important. One common example of poor structure leading to hazardous conditions is a sharp "V" crotch--where two large trunks or branches join tightly together in a "V-like" configuration. This means the tree probably has an internal bark-to-bark connection (a structural defect

referred to as "included bark"), which is really no connection at all. One or more of these competing trunks or branches may fail, splitting away. On the other hand, branches that grow out from the trunk in a horizontal direction are likely to form a stronger bond. Generally, "U-shaped" crotches are stronger than "V" crotches. This problem can be resolved with proper pruning, and the earlier the better. Live oak (*Quercus virginiana*) is a conundrum in this case. It has a tendency to form a lot of "V" crotches; but it is a great tree, with ultra-strong wood. It may be fine with a modest size "V," but fail with the large V-joint. No doubt it is best to prune Live oaks early in order to promote horizontal branching and strong branch unions.

Obviously, we should survey our trees for dead branches, or recognize a tree if it's entirely dead. With a dead tree especially, there is another important observation, or consideration. Is there a target? In other words, what's the worst thing that can happen if the tree or branch falls? Is it likely to strike everything? If it can't hit anything important, it has no significant target. Dead trees are actually vitally important to many cavity nesters, such as woodpeckers, owls, other birds, flying squirrels, and many additional critters. Consider leaving a dead tree standing if you can safely do so. Even after it falls on the ground, dead wood is a valuable resource for an assortment of animals. In some instances, dead wood can create an entire habitat.

Here are some other, less common hazards. Does a tree have a large rotten, decayed area? Are their mushroom-like growths forming in decayed areas. Rotten areas never heal. The tree will fight to keep the decay from progressing further into good, sound wood. If the tree is healthy, it will triumph for quite some time. If the tree is unhealthy or stressed, the decay may gain the upper hand. Is the rotten area large enough and in a position to cause the failure of the tree or limb? To assist your tree, in a fight against decay, prevent any-and-all injury to the bark of a tree. The bark is the tree's natural defensive barrier against decay. Lawnmowers and weed eaters are big-time culprits in this regard. Improper

pruning of branches also exacerbates injuries and decay.

Cankers are sunken, misshapen areas, usually on the trunk of the tree. About 30% of pine trees have cankers from a disease called fusiform rust. A canker can cause a tree to be hazardous if it extends too far around, or into, the trunk of the tree. If it is more than half way through the tree's trunk, there are increased concerns.

A deep crack through the bark of the tree, into the wood, may indicate the tree is already failing. It's natural for bark to look like it has minute cracks all over the place. A long, deep crack that appears to go all the way through is a serious warning sign.

So which trees hold up best in hurricanes? The latest research suggests Live oak (*Quercus virginiana*) and sabal palm (*Sabal palmetto*) are the real champs. Southern

Magnolia (*Magnolia grandiflora*), sand live oak (*Quercus geminata*), dogwood (*Cornus florida*), pecan (*Carya illinoensis*) (sheltered in a non-orchard setting), and bald cypress (*Taxodium distichum*) are also real "stand-up" performers. Some of the worst include laurel oak, water oak, sand pine, Carolina laurelcherry (*Prunus caroliniana*), red maple (*Acer rubrum*), and turkey oak (*Quercus cerris*). Sweetgum (*Liquidambar styraciflua*) and red cedar (*Juniperus virginiana*) have a tendency to break in hurricane winds. Don't

panic though, scientific surveys show that only 1-2% of trees that failed during hurricanes caused damage to property.

Do your trees have crown decline, V-crotches, dead branches, large areas of decay, cankers, or deep cracks? These are some of the tell-tale signs of tree defects that homeowners should look for. Does the hazardous tree have a target? If so, tree

work, and perhaps removal, is probably warranted. A qualified arborist is a great resource for a more in-depth analysis.

Planting trees correctly and planting "the right tree in the right place" can get a tree off to a great start. Proper pruning of young trees is worthwhile. Pruning older trees can be extremely beneficial. Detrimental pruning techniques as "topping" and "lion tailing" should be avoided. Research indicates that the practice of crown thinning to mitigate wind damage from hurricanes is actually harmful. Avoid disturbing a tree's root system--most of the absorbing roots of a tree are at a shallow depth of only 3 to 12 inches in the soil. Avoid the CRASH by promoting the health of your tree(s). Identifying tree issues ahead of time and doing something about it depends on you.

"Don't panic though, scientific surveys show that only 1-2% of trees that failed during hurricanes caused damage to property."

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Hurricanes and Trees: It's Complicated



OCTOBER 5TH, 2017 | 0 COMMENTS

By Ian Leahy, *Director of Urban Forest Programs*

When I took a city government job caring for trees after having run my own business, I thought life in government would be a walk in the park, so to speak. No more payroll to meet, or sleepless nights about finding new clients.

Then the first major storm hit while I was on 24-hour call.

Working on behalf of the citizens of Washington, D.C., I found myself racing through nearly empty city streets at 3:00 a.m., scanning for any trees that might be coming down on us from above in the wet soil and wind. It was a long and stressful night, feeling the weight of the city's safety on my shoulders.

This was not a one-time occurrence. We were in all-hands-on-deck mode after hurricanes, derechos and ice storms, working day and night to get trees out of streets, off of smashed cars, and sometimes even out of bedrooms. Each step, we scanned intensely with an eye out for downed live power lines.

As the city would become functional again, we would inevitably be inundated with calls from residents to remove perfectly healthy street trees that survived the storm. They saw the damage trees could do and, perhaps understandably, wanted no part of it.

So where do trees fit as a public safety measure in the face of extreme weather?

TREES AND COMMUNITY RESILIENCE

The relationship between trees and storms is a complicated one, as evidenced by images from Puerto Rico and other Caribbean islands of entire forests stripped of their leaves overnight.

At first glance, a community could impulsively conclude that trees aren't worth the hassle, at least outside of parks. But, such a community would be stripping itself of a vast array of benefits, from air quality and reduced urban heat island to improved academic performance in children, reduced hospital recovery times and, yes, even — perhaps especially — stormwater management.

When trees filtering water are removed, time and again massive flooding that otherwise would not have happened on such a scale is unleashed, causing crippling damage to people's lives and the economy.

LESSONS LEARNED ABOUT WIND AND TREES

So how do we balance these very real risks with such prolific benefits? The key is to actually double down on and enhance a city's tree canopy. Scientists at the University of Florida tracked the impacts 10 hurricanes had on the urban forests where they hit, from Andrew that devastated South Florida in 1992 to the infamous Katrina along the Gulf Coast in 2005.

While they found that increased wind speed did increase the likelihood that trees would fail, other factors significantly impacted the degree of damage to a city's tree canopy during a hurricane:

- Trees in groups survive wind better than individuals
- Some species resist wind better than others
- Trees that lose their leaves during a hurricane are not necessarily dead
- Better and deeper soils mean fewer tree failures
- Native trees survive better
- Older and unhealthy trees are more likely to be damaged
- Well-pruned trees survive hurricanes better



Tree damage in South Florida from Hurricane Irma in 2017. Credit: Jim Mullhaupt

All of this demonstrates the life, infrastructure, and economy-saving importance of cities investing adequately in an urban forestry program. This includes hiring technical expertise and giving forestry a seat at the planning table when decisions are made about every aspect of the city's built environment.

While risk of tree failure can never be completely eliminated, going all-in with a truly comprehensive urban forestry program would reduce risk significantly by:

- Developing and implementing a comprehensive urban forestry plan
- Conducting structural pruning for both young and mature trees
- Planting more wind- and salt-resistant species
- Selecting the right species and designing the right place, with adequate soil volume
- Planting high-quality trees with central leaders and good structure
- Assembling an urban forestry strike team to deploy in the wake of disasters

VIBRANT CITIES LAB

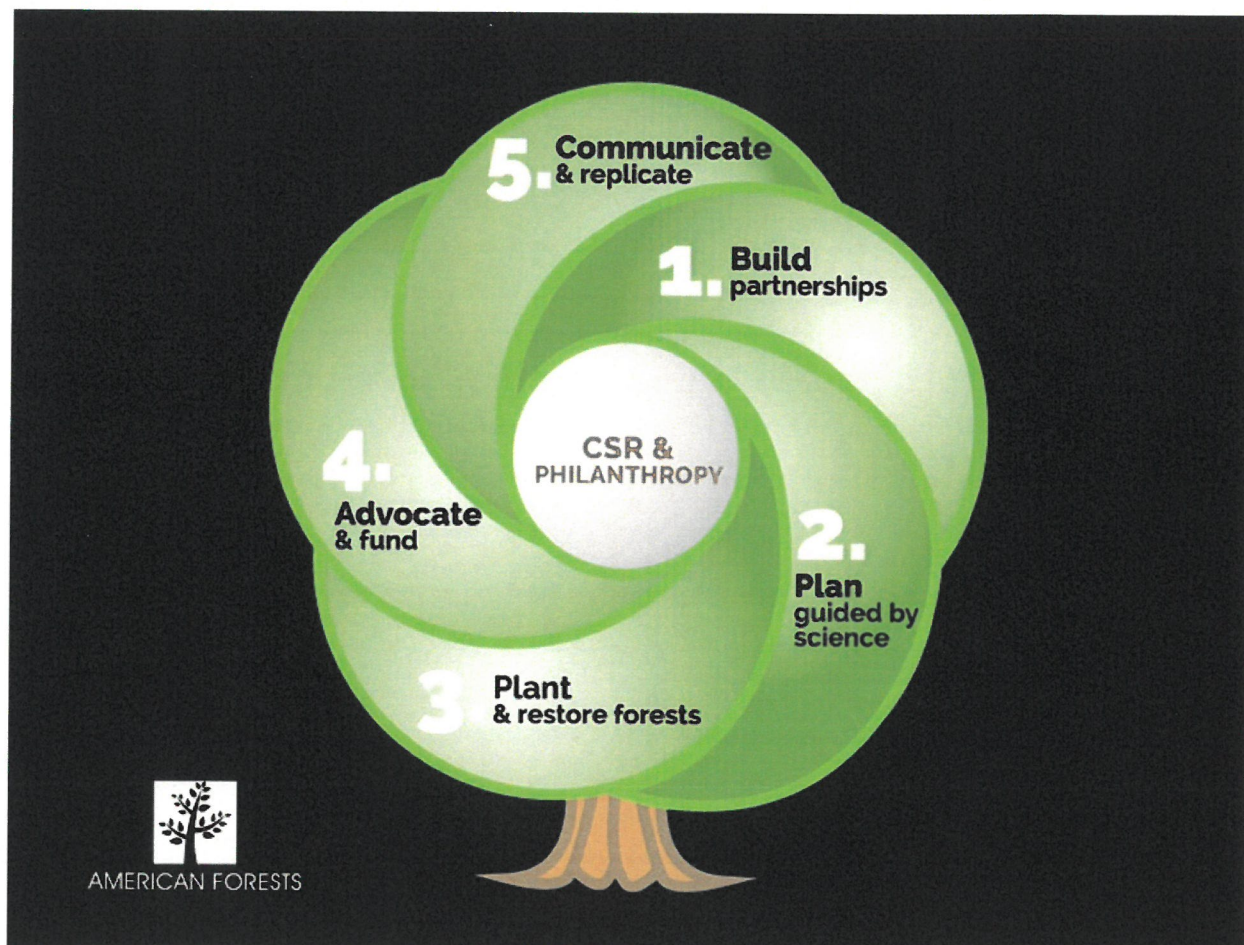
To help communities of any size build such a comprehensive urban forestry program, American Forests, the National Association of Regional Councils (NARC) and the U.S. Forest Service recently launched the [Vibrant Cities Lab](http://www.vibrantcitieslab.org). This free online hub is a unique portal of

urban forestry research and expertise to help city managers and other professions integrate trees into their decision-making processes.

The Vibrant Cities Lab includes a step-by-step guide so that any community can assess where they currently are and access the technical resources necessary to enhance their urban forestry capacity. The site synthesizes the latest research showing impacts trees have, provides best practices from communities of all sizes, and curates nearly 500 resources, such as technical guides, ordinances and sample urban forestry plans.

DISASTER RELEAF FUNDS IN MIAMI AND HOUSTON

American Forests has also been working for several years in Miami and Houston, two cities recently devastated by hurricanes, to help develop just this kind of holistic urban forestry capacity that can build community resilience. With the support of Bank of America, Alliance Data, Coca-Cola, Bacardi and the U.S. Forest Service, among others, our award-winning Community ReLeaf program works in metro areas nationwide to increase local capacity through a comprehensive theory of change model:



While these partnerships in Houston and Miami have looked to build a strong and expanded tree canopy for the future, focused on underserved areas, the damage inflicted on each city's trees by Hurricanes Harvey and Irma have created new and urgent work that complicates the way forward. We need to update our data and planning on local tree canopy, identify repair and restoration needs, and incorporate lessons learned from these storms to identify how trees can be used to prepare for future events.

To help fund this new work with our partners, American Forests has launched a [Disaster ReLeaf Fund](#) for each city. We are also expanding our planting and maintenance efforts so both Miami and Houston can recover their beneficial tree canopy as quickly as possible.

Whether in a large metro area or a small town, proactive management can help your community's trees not only better withstand hurricanes, but also become an asset for filtering water and reducing impervious surfaces at a time when those functions are most desperately needed.

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