



Reduce the Risk of Storm Damage

Arizona's monsoon season brings high winds that can cause serious damage to landscape trees resulting in huge economic losses. Sometimes damage can't be avoided but in the majority of cases tree failures are the result of mismanagement of our urban forest.

The word "monsoon" comes from the Arabic "mausim" which means "a season. In Arizona, the process starts with the hot and dry weather of May and June. During this time the winds are from a dry westerly direction, so humidity is low and temperatures soar above 100 degrees in the deserts. As the atmosphere warms, the jet stream retreats northward. This allows the winds to shift to a more southerly component and bring in moisture. Most of our humid air comes from the Sea of Cortez, but a good portion also comes from the Gulf of Mexico. Once the moist air arrives, our strong summer sun heats the moist air causing the familiar thunderstorm clouds.

Here are some common Monsoon Terms:

- Dust storm – walls of dust coming from the south, can get 3,000 feet high
- Gustnadoes – combination of dust devils and tornadoes
- Dust Devils – micro-tornadoes that reach up to 1,000 feet tall, majority are pretty small.
- Downburst – contain strong down drafts, 2 types
 - Macrobusts – 2.5 miles or more in a diameter section and last for 5 or 20 minutes.
 - Microbursts – 2.5 miles or less in a diameter section with winds forced and bursting outward. These cause the most damage.

Why Do Trees Fail in High Winds?

There several types of failures.

- Root failure
- Trunk failure
- Branch attachment failure
- Branch failure

There are six key reasons why trees fail.

1. Nursery Production Techniques
2. Tree Site Incompatibilities
3. Pruning / Planting Practices
4. Disease Pathogens and Insect Pests
5. Watering
6. Genetics

Let's look at the reasons one at a time.

- 1. Nursery Production Techniques.** This refers to root deformation at the nursery resulting in a girdled root system. Roots grow and follow the boundary of the container creating a circular pattern. After planting the roots begin to grow around the main stem of the tree and cut off or restrict the movement of water, plant nutrients and stored food reserves.

To avoid girdling roots, select quality nursery stock and visually inspect the tree. Buy young stock, rather than old stock. Look for roots protruding above the soil line. Use your finger to

probe the soil near the trunk to feel for girdling roots. At planting, score the rootball in several places to interrupt any circling pattern. Other techniques that arborists may use include shaving the roots and air excavation of the roots. A healthy rooted tree is able to distribute stress and minimize a chance of it being uprooted.

- 2. Tree Site Incompatibilities.** Unfavorable site conditions can cause the development of stresses. This reduces their ability to withstand pathogens and insect damage. Some species are not suited for particular sites such as parking lot islands or street medians. Some species do not tolerate lawn conditions or soggy soils. Some species should never be planted under power lines where, because of their height, they are subject to line clearance practices. Care should be taken when planting trees near structures where, if placed too closely, they can interfere with roofs or walls. The motto of “right tree – right place” should always be used when planting a tree.
- 3. Pruning / Planting Practices.** Pruning can actually contribute to failure. Trees that are pruned into pre-formed shapes sets them up for failure. For example, lifting the canopies of trees creating the ‘umbrella effect’ allows wind to lift the tree. Excessive thinning disrupts the equilibrium of the trees canopy. Dr. Chris Martin from Arizona State University says: “Trees are self-optimizing structures, when a force hits them on a certain side; they distribute the stress equally to minimize it so the tree is able to stand. When we mess around with the tree and limit its ability to distribute equally around the tree that causes stress, and we see failure.” Removing the interior branches and foliage or ‘lions tailing’ redistributes the weight to the ends of the branches making them more vulnerable to wind damage. There are multiple reasons we see large branch breakage during monsoons. It can be said that trees that are managed this way are selected for failure.

Planting procedures can also contribute to ‘wind throw’ or trees blowing over. Trees placed too deeply in planting holes are subject to backfill that can suffocate the root crown. Some arborists report that 95% of trees are too deep in the top of the container before planting. Holes dug with augers create smooth sides that roots have difficulty growing through. Amending the back fill can be detrimental to root growth. Staking ties that aren’t loosened periodically can strangle trunks and create weak points subject to breakage. The practice of removing small branches on the trunk contributes to sunburn and restricts nutrients distribution for the tree.

- 4. Disease Pathogens and Insect Pests.** The process of wounding trees in pruning causes rampant wood decay. Dr. Chris Martin did a survey of primarily commercial trees, and found incidences of slime flux and other forms of wood decay on 61% of the trees. The greater majority of trees in commercial settings are in some state of wood decay. Fungal and bacterial pathogens can affect stressed trees.

There are two common wood boring insects that affect stressed trees. The flatheaded borer attacks dying or dead wood. An example would be wood damaged by sunburn resulting from branch removal. The tree is stressed from pruning and produces chemical signals that attract the borer. Roundheaded borers are less common and are found in living tissues of stressed trees.

- 5. Watering.** Excessive watering of trees reduces wood density and mechanical stress tolerance. An overwatered tree will have larger vessels, larger grains of wood, which makes it weaker. Strength is derived from density or packing of vessels. Chronically over irrigating causes wood density to decline. This is particularly problematic with desert tree species

planted in the city. Reduced wood density causes less ability to withstand stress. In an over-irrigated situation it also affects the shoot to root ratio, resulting in reduced ability for the tree to be stable. The root system is smaller than it would normally be and in high winds the tree is not stable. The practice of limiting water and fertilizer serves to significantly slow growth and reduce the need for pruning and thinning. Good tree water management can help keep a tree stable in winds.

The location of the irrigation lines is also critical to trees stability in the soil. Moist or saturated soil is very unstable. As a tree grows, the emitters should be placed at the drip line where the majority of the feeder roots are located. This allows the soil next to the trunk to become more firm as it dries out, decreasing the possibility of wind throw.

- 6. Genetics.** Sometimes arborists are faced with nearly impossible situations that even the best pruning can't help. A few tree species present growth characteristics that defy logic. One common problem is narrow branch attachment angles that is often a point where tree branches fail. This failure usually is from included bark. Included bark is bark embedded or turning inward between opposing branches, a branch and a main trunk or two co-dominant branches creating a structurally weak point in the tree. It prevents strong attachments of branches, often causing a crack at the point where branches meet.

Summary

What's the biggest problem? There is no single answer. A tree functions as a unit that includes the leaves, branches, trunk and root system. What is done to one part affects all the other parts. Anything done to the top of the tree affects the roots and vice versa. To avoid tree failure, the entire tree must be managed appropriately.

Tips for Storm Damage Prevention

- Select tree stock from reputable nursery.
- Select the 'right tree for the right place'.
- Use the Tipton Planting Method by digging a shallow and broad planting hole. Refer to the ACTC Tree Planting Guide https://www.aztrees.org/Resources/Documents/Planting_Guides/tree_planting_guide.pdf
- Avoid layering of different soil types. (topsoil layered atop of rock or caliche.)
- Score root-ball sides at installation.
- Prune no more than 20% percent to open canopy, keeping top growth and foliage in proportion to root mass.
- Avoid removing foliage during seasons when sunburn can result.
- Design an irrigation system that encourages progressive radial distribution of roots as trees mature. Ideally, the irrigation system should allow separate water scheduling for trees and shrubs. Water deeply, but infrequently. Refer to [Landscape Watering by the Numbers](#)
- Irrigation schedules should allow soil and roots to drain and dry slightly before water is reapplied.
- Identify co-dominate leaders early and remove the smaller of the two branches or the one supporting least overall mass.

Attention Private Tree Owners – don't attempt to prune or remove any trees that are within 10 feet of overhead power lines. Call your local utility to set up a temporary disconnect to make the situation safe. Call a Certified Arborist or Certified Tree Worker to complete work in these situations.

