Photo by Ryan Mitchell

Blowing in the Wind: Advantages of Longleaf Pine in Wind Storms

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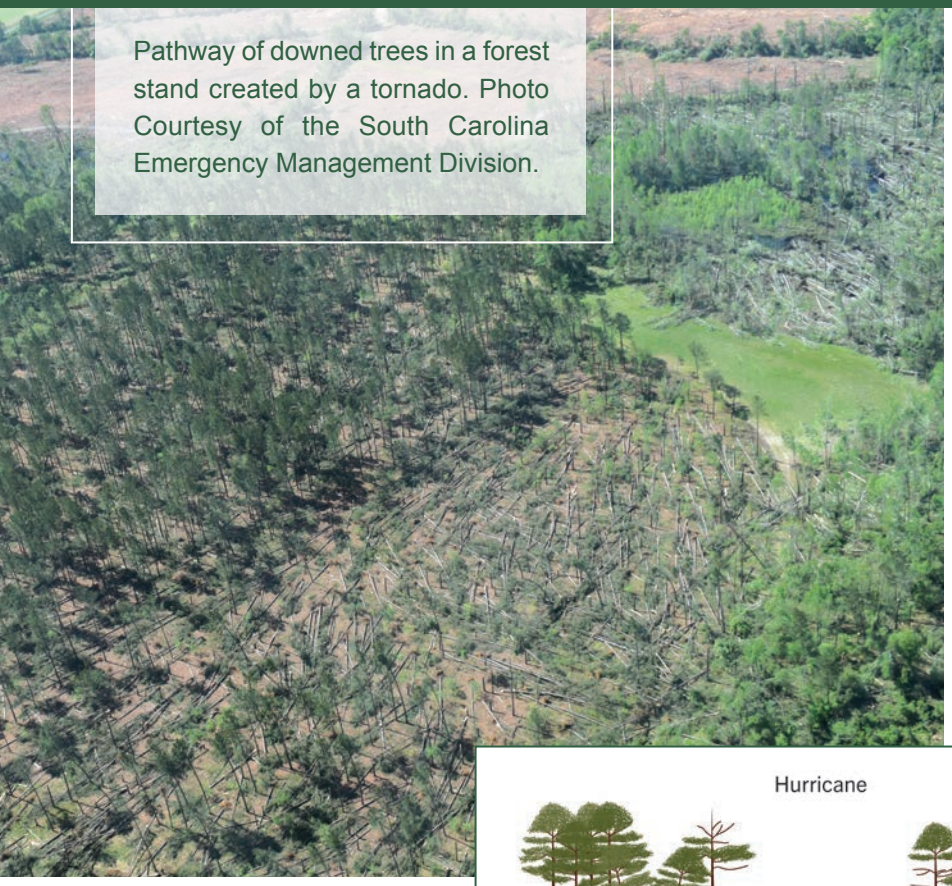
Windstorms, such as hurricanes and tornadoes, can cause tremendous damage to forest stands and the impacts can be felt by a landowner many years after a storm event. Hurricanes and tornadoes can decrease the volume of merchantable wood in the forest and can negatively impact or degrade many other ecosystem services offered by the forest including wildlife habitat, water quality, and carbon sequestration. The impact of hurricanes in the southeastern U.S. is expected to increase over the next several decades, and tornado frequency and intensity will continue to impact humans and the ecosystem. Despite the relative infrequency of hurricanes and tornadoes, landowners should work towards having a long-range approach to sustainable forest management in addition to managing the threats of today (which can include forest pests and competing vegetation).

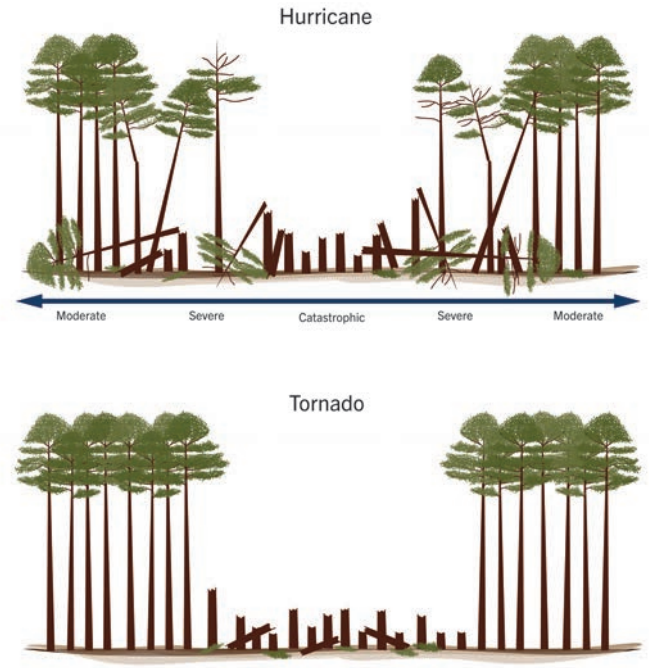
Landowners in storm prone areas should consider wind threats when making management decisions, such as tree species selection or thinning, to decrease their risk and protect their economic and ecological interests. While there is no silver bullet that can prevent hurricane or tornado damage, longleaf pine offers benefits worth considering. In fact, many native coastal species such as live oak, bald cypress, and longleaf pine are better adapted to hurricanes and other wind-related disturbance events.

Hurricanes and tornadoes result in different types and patterns of wind damage. Hurricanes leave a gradient of wind damage. The eye wall, the part around the calm center or eye of a hurricane, has the strongest winds and rains. Stands in the path of the center of the storm often experience the most storm damage. Moving outward from the center, the wind intensity decreases, but it can be highly variable depending on the storm. Hurricanes rotate counterclockwise, and winds on the eastern (or right) side of the storm as it moves forward and typically northward can be more intense because the force is higher. Most damage from tornadoes, on the other hand, occurs within the storm's path, often leaving a more distinct "cut path" where the storm travels.

Damage (including breakage and uprooting) and mortality is often less in longleaf than slash or loblolly pine after hurricanes. For instance, 73% of longleaf pine was undamaged compared to 48% of loblolly pine in Hobcaw Forest, 100 km from the eye of Hurricane Hugo which hit the coast just north of Charleston, SC in 1989. Even when stands were of different ages and stocking, longleaf was the most resistant pine, followed by slash and then loblolly. Preliminary studies being conducted after Hurricane Michael, which occurred in 2018, are yielding similar results. Research from southern Mississippi showed that longleaf pine suffered less damage than slash or



Pathway of downed trees in a forest stand created by a tornado. Photo Courtesy of the South Carolina Emergency Management Division.



Characteristic impacts from wind storms. Hurricanes can cause a gradient of damage while tornadoes cut more of a distinct pathway. Figure by Bek Diamond, Clemson University.

Damage to trees within a forest stand from hurricanes and tornadoes can vary in scope and scale.

loblolly after Hurricane Katrina in 2005. While tornadoes tend to damage all tree species in their path, longleaf tends to show better recovery after a tornado than some other southern pines.

Why is longleaf more resistant to wind damage?

Many contributing factors influence how wind can damage trees. The ultimate factor in how much damage a hurricane does to a forest stand may be the proximity of a stand to the eye of a hurricane and the strength of the winds. For tornadoes, it's a little more straightforward – trees in the path are very likely to get damaged, while those outside the path will likely be spared. However, even if a tree is spared from obvious wind damage, there may be damage that's not visible to the naked eye, and this damage can weaken the tree and increase its susceptibility to insects and pathogens.

Other factors that play a role include tree species and stand structure (height to diameter at breast height ratio, age, etc.), wind speed, and site characteristics such as topography and soils. Forest composition, tree spacing, time since thinning, and height-to-diameter ratios are also important factors that may impact windthrow. Longleaf pine's growth characteristics can be a benefit contributing to its greater wood strength and density which are critical to wind resistance.

Longleaf pine also is naturally found in areas that are prone to frequent storm events, and there is some evidence supporting the idea that selection pressure for resistance to wind has occurred over time. Other physical characteristics of longleaf may also be beneficial compared to other species – for instance, loblolly and slash pine have denser foliage than longleaf, which may contribute to increased stem breakage in those species, and longleaf pine has a large, deep taproot which serves as a sturdy anchor during wind storms.

Impacts of Hurricane Michael on a forest stand located within 5 miles of the eastern eye wall with sustained winds over 150 miles per hour. Photos by Ryan Mitchell.

Before & After a storm

Managing your longleaf pine after a storm event

So, it happened…now what? After a wind event occurs, there are short-term considerations involving loss of merchantable timber and clean-up as well as long-term considerations for potential hazards (i.e. insect outbreaks and wildlife) and re-establishing the site. Damage often occurs twice after large storms: immediately, and then again about 12-18 months after the storm. The immediate damage is obvious, in the form of uprooted, broken, or bent trees. Delayed tree injury or mortality often occurs from several factors including sublethal injury and bark beetles or other pests. Trees may survive the initial storm and look healthy but may actually have internal or physiological damage that is not visible. This can weaken the tree and increase its susceptibility to secondary pests.

Develop a plan well in advance of a storm. Have your plan and contacts ready. A professional forester can help assess the damage, appraise the timber, and set up a sale, clean-up, or re-establishment. To that end, it is beneficial to have an ongoing working relationship with a professional forester, as they can help you with land management in general – not just after a disaster. There may also be disaster related federal aid programs through the USDA Farm Service Agency (FSA) or Natural Resources Conservation Service (NRCS) or state forestry agencies. Depending on the level of damage incurred, there may also be casualty loss tax deductions that can be taken if a basis of value has been set prior to the storm. Again, it's best to work with a professional to make these determinations.

Assessing your timber

It's important to assess your timber stands after a storm. Trees may be leaning or broken, or perhaps there's just some breakage in the branches. Extensive limb damage and broken tops are often catastrophic injuries for pines, while sometimes trees get twisted during strong winds and the damage isn't immediately evident. Understand which trees (based on their current condition) may not survive in the long run and need to be salvaged. Also, damaged trees are stressed trees, which could encourage insect and disease outbreaks.

In addition to assessing a stand immediately after a storm, revisit the stand when making plans for reestablishment. Often heavy mechanical work is unavoidable. However, if natural regeneration occurs, the stand may not need to be treated with herbicides or replanted.

Salvage logging

Following a storm, it's likely that not only you, but also your neighbors, were impacted. This can make it difficult to line up crews to salvage the timber, lower the landowners return, and create an excessive supply of wood, overloading the market and lowering prices. When large storms occur, the crews that harvest the timber and the mills that process the timber may very well be affected too. These events can create a situation where there's a glut of timber on the market and a lack of harvesting crews or operational mills. Unfortunately, this means that salvage may not be an option for some landowners who own smaller acreages. In this case, landowners are

advised to focus on cleaning up their stands (via mulching, piling and burning damaged trees, or carefully administered prescribed fire to remove debris) to prevent further damage from secondary pests and other tree health issues. Check with your State Forestry agency and local municipality to confirm burning is allowed and what the legal requirements are to burn on your property after a storm. Often there's not much that can be done, but it is important to understand the challenges that may be faced.

Conclusion

In the Southeast, the frequency and intensity of storms is expected to increase in the coming years. And, while no tree species can withstand the full force of a direct hit from a hurricane or tornado, some species, like longleaf pine, are better suited than other species at withstanding high winds. If your land is in an area subject to hurricanes, tornadoes, or other storms that often come with high winds, the ability of your timber to withstand wind damage should be a consideration.

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