

Tornado and Straight-Line Wind Damage to Hardwood Stands: *Frequently Asked Management Questions*

Just as Hurricane Katrina caused extensive damage to hardwood stands, the tornado outbreak during the spring of 2011 caused a similar type of damage. After such events, many landowners in north and central Mississippi face difficult decisions concerning the future management of their hardwood stands.

The purpose of this publication is to provide information to landowners to help answer those questions. However, landowners are strongly encouraged to seek the advice of a professional forester or others knowledgeable about hardwood management before making final decisions about individual stand management. At the end of this publication is a list of agencies you may want to contact for advice and articles.

Before addressing particular questions about management of hardwood stands, it is necessary to understand the types of damage caused by tornadoes and the resulting effects on the trees (mortality, growth rate, value). Common types of damage include the following:

- **windthrow (the tree is uprooted and blow down)**
- **broken stems (in some cases twisted by the wind)**
- **broken limbs**
- **leaning trees**
- **bent trees**
- **trees with major wounds**

Often, trees will exhibit a combination of these injuries.

Windthrow (uprooting) damage to hardwood stands is common, and, in the worst cases, almost all stems of commercial value are lost. Large, mature trees are susceptible to windthrow because the area of mass above the ground is much greater than the root mass (**Figure 1**). This is an even bigger problem if the roots are not sufficiently deep.

If a stand has suffered excessive windthrow, the only viable option is salvage and a complete harvest to regenerate the stand. The questions then become how and when the salvage should be done and how the stand will be regenerated. These decisions will be discussed later.

One fortunate aspect of windthrow is that there is usually less damage to the bole of the tree than from other type damages. It is often possible to use the tree

for the same products it would be used for if normally harvested. Therefore, the decrease in value will be minimal. However, it is still hard to harvest the stand because, in many cases, the trees will be stacked on top of one another in a random fashion.

Extremely high tornado winds can cause stem breakage, especially in younger hardwood trees, as shown in **Figure 2**. Broken stems in mature hardwood trees often occur at weak areas such as a fork or a previous injury that has begun to decay. Broken stems result in far greater value loss in hardwood trees of sawtimber size than does windthrow. Splintering, fiber pull, and reduction in merchantable lengths all limit the use of the tree for higher value products such as lumber and veneer. Also, logging cost for salvage is greater when the trees are broken.



Figure 1. This windthrown hardwood illustrates the depth of soil and rooting zone in comparison to the stem.



Figure 2. This hardwood stand shows primarily broken stems.

Broken limbs, including at the top of the tree, generally are not as serious a problem in hardwoods as in pines. Hardwood trees may suffer a 50–75 percent loss of crown and be able to survive and establish a new crown (USDA Forest Service, 1998) (**Figure 3**). However, this depends somewhat on the type of breakage. If limbs larger than 3 inches in diameter are broken and cause major wounding to the bole of the tree, the tree is not likely to survive for long periods (years) because of decay and/or future stem breakage (**Figure 4**).

Leaning trees are an indication of partial uprooting. If the lean is less than about 45 degrees and there is no other major damage, these trees are very likely to survive and grow at an acceptable rate. It is not necessary to remove them in a salvage cut, although they likely should be removed in the next harvest operation in the stand.

Bent trees are most common in younger stands of saplings and pole-sized trees. These trees are also capable of recovery and should receive a low priority for removal in a salvage cut.

Boles of standing trees can be severely wounded by falling trees and blowing objects during tornados or straight-line winds. These wounds will result in degradation of the stems but usually do not result in immediate death of the tree. Except in the case of very severe wounds, the trees will continue to grow and remain an important component of stands that can be managed following the damage.



Figure 3. The crown of this hardwood tree shows limited breakage (less than 50 percent of the crown), indicating a probable full recovery.



Figure 4. The crown of this hardwood tree shows considerable breakage (greater than 75 percent), so the chance of recovery is very low.

Frequently Asked Questions

Can my damaged hardwood stands be managed, or should I harvest the standing timber along with the salvage operation?

After a significant weather event, hardwood stands may resemble piles of straw (**Figures 5 and 6**). In a matter of minutes, decades of growth can be destroyed. Often, the first impression is that there is not enough left to manage, but avoid making hasty decisions until you have thoroughly assessed the financial and biological situation.

You should almost always employ a simple salvage operation to use dead trees or those not capable of responding and growing, provided it is economically feasible. However, the question is: Do you have desirable species that will continue to grow and meet your objectives for the stand? Consider the severity and type of damage, the age and history of the stand, and your long-term objectives. The type and severity of damage is the most important issue. Tornado and straight-line wind damage may vary from complete blow-down of all commercial timber to simple limb and top breakage.

Before deciding whether to harvest and regenerate or salvage and manage, make a thorough assessment of the stand. Observations from the air or from the edges of the stand may not be adequate. Concentrate primarily on the standing trees and not what should be salvaged, although you can evaluate that at the same time. It should involve

observations/measurements of stocking (trees per acre), composition (are the standing trees desirable for my management objectives?), type and severity of damage, and distribution of the damage (is it uniform throughout the stand or in patches?). A professional forester with experience in hardwood management is the best person for this job.

Every situation is different and depends on the landowner's objectives. However, follow these general guidelines if continued production of hardwood timber is a major objective.

- If an assessment of the stand indicates that there are 35 or more trees per acre of desirable species with the capability of responding and producing good crowns and acceptable growth rate, manage the stand.
- Remember that, following extreme weather events, a considerable amount of wood will be on the market, which lowers returns to the landowner. If the stand can be managed without significant loss from secondary pests, it may be financially beneficial to delay harvest for a short time.
- If there is only minimal damage to the bole and the larger limbs, manage the stand. The ability to respond is determined primarily by the condition of the crown. Previous work (Barry et al., 1998) has shown that trees with less than 50 percent crown loss are capable of full recovery but with some loss of growth. At 50–75 percent crown loss, many hardwood trees will recover and can be retained for several years, but there will be a loss in growth.
- If providing wildlife habitat (especially hard mast-producing trees) is a major landowner objective, you may want to manage the standing trees even if there are less than 35 trees per acre. In either case, management techniques will be altered in these stands as discussed below.

More than 50 percent of trees in my hardwood stand have been either uprooted or severely damaged. What are the disadvantages of harvesting the remainder of the trees in conjunction with the salvage operation?

The biggest disadvantage may be a large financial loss. Since a large volume of material will be on the market following a tornado, stumpage values are likely to be low. Furthermore, the higher value trees are likely to be sold at prices established for salvage material. If the residual stand can be managed for a few years, even though the stocking is less than desirable, stumpage value is likely to increase considerably.



Figure 5. The random pattern of tornado winds makes salvage more difficult.



Figure 6. Straight-line winds result in a uniform pattern of windthrow, which makes salvage operations less expensive.

Another distinct disadvantage is that a complete harvest may eliminate the possibility of natural regeneration for the next hardwood stand. If there is no advanced regeneration of the desirable species, natural regeneration becomes impossible. If a residual stand, even at low density, can be maintained, it may serve as seed trees for a new stand. This is similar to regeneration using the shelterwood method.

Complete stand removal may be a viable choice when there is ample advanced regeneration of desirable species. In that case, the removal would be essentially the same as the final harvest and regeneration cut for a managed stand.

How can I determine if I have adequate advanced regeneration of desirable species to initiate a new hardwood stand?

A professional forester or someone with experience in hardwood management should make this determination. However, a simple model was developed by the forestry department at Mississippi State University to help landowners make that decision. The model and instructions are available on CD. For this resource, contact the forestry department at Mississippi State University.

How much time do I have for the salvage operation?

The highest priority for salvage should be given to the products with the highest value. If you have both pine and hardwood, highest priority should be given to pine sawtimber trees because of the probability of rapid degradation by blue stain. Second priority should go to hardwood sawtimber. Salvage of pine and hardwood pulpwood may be delayed as long as 8–12 months. Uprooted or broken hardwood sawtimber trees should be salvaged as quickly as possible, but, depending on the weather, salvage can take place after 4–6 months.

In addition to uprooted and broken trees, what type of standing trees should be removed in the salvage operation?

Trees that are unlikely to survive to the next harvest operation in the stand (5–10 years) should be removed. This is determined primarily by crown condition and damage to the bole of the tree. As a general rule, trees with more than 75 percent of the crown destroyed should be removed, but some of these could be left for wildlife habitat purposes. Remove trees with severe wounds that make loss from breakage or decay likely.

Additional Sources of Information

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