MISSISSIPPI STATE UNIVERSITY EXTENSION

Thinning to Mitigate Extreme-Weather Risks

There are numerous risks involved in the business of growing and managing timber, and, in the southeastern United States, extreme weather is always a concern. Due to its geographic location and climate, Mississippi already experiences above-average threats from nearly all types of weather events, including tornadoes, severe thunderstorms, hurricanes, drought, wildfire, ice storms, and flooding. In addition to the risk associated with the main effects of extreme weather, stands damaged during weather events often have higher incidence of forest health issues that affect damaged or declining trees. As a result, even long-time forest landowners often underestimate the risk that extreme weather presents to their property.

Forest landowners are not completely defenseless against extreme weather. While it is true that little can be done to prevent damage if a hurricane or tornado directly occurs over your property, there are silvicultural steps you can take to reduce your risk from other less-extreme forms of weather. One such step is thinning. Thinning reduces competition for light, water, and nutrients, thereby reducing stress and restoring growth rates and vigor. Increases in growth and vigor not only shorten the length of timber rotations, but also reduce the risk to some extreme-weather events. The goal of this publication is to provide information on how thinning will affect your risk to different forms of extreme weather. This information will help Mississippi landowners decide whether thinning is the most appropriate silvicultural strategy for reducing risk to extreme weather on their property.

Wind

Extreme wind, in the form of tornadoes, severe thunderstorms, and straight-line winds, is perhaps the most frequent extreme weather threat to timber stands in Mississippi. In pine stands, wind primarily causes broken stems, whereas in hardwoods, wind may cause trees to fall due to shallow rooting systems on saturated soils. In wind events, trees in the interior of denser stands are at lower risk because edge and/or exterior trees actively reduce wind speed. Higher-density stands also sway less because of crown-to-crown contact with neighboring trees and belowground root grafting, which also limits the risk of stem breakage and uprooting.

Consequently, thinning actually increases the risk to wind damage within stands, and this happens for two reasons. First, by removing trees, thinning lowers a stand's natural ability to resist wind, resulting in higher wind velocities within the stand. Second, by increasing the spacing between trees, thinning reduces much of the crown and root system support provided by neighboring trees. Taken together, thinning creates a scenario where trees experience higher winds than normal and have less surrounding support to rely on. Fortunately, however, wind risk is only elevated for the first 2–3 years after thinning because trees' wind resistance increases as they grow in diameter, and neighboring crowns and root support systems begin to redevelop.

Drought

Drought is probably the second-most frequent form of extreme weather event in the South and is usually even "expected" in its mildest form on an annual basis. Mississippi usually has wet winters and springs, hot and dry summers, and short, cool, dry falls. Thus, on average, during much of the summer and fall, trees in Mississippi experience moisture deficits. Under moisture deficits, trees are less photosynthetically active, leading to decreased vigor and increased risk to insect attack and mortality. Even without mortality, reduced growth and longer rotations will likely result from frequent drought. Thinning forest stands is beneficial in all drought situations, whether mild or severe, because the practice increases the amount of moisture reaching the forest floor and decreases competition for that moisture, while facilitating greater root system development. This shortens timber rotations and reduces future susceptibility to drought, as well as decreases your risk to extreme fire behavior and attack from native boring insects at normal population levels.

Fire

Low-intensity surface fires are common to many Southeastern forest types. In fact, many native pine and oak species have thick bark that makes them naturally resistant to fire and able to survive low-intensity surface fire events. What most native tree species are not adapted to is surviving high-intensity crown fires.

Thinning is an excellent silvicultural tool for reducing risk to fire. Removing trees reduces the amount of forest fuel (branches, twigs, leaves) on the forest floor. With fuel loads reduced, fires are generally smaller in stature and lower in intensity. Consequently, surface fires rarely transition from the forest floor into the crown. Much of this process, however, depends on the type of thinning used. Whole-tree harvesting will reduce fire risk because most biomass is removed during the harvesting process. On the other hand, methods that leave sub-merchantable biomass on site (for example, tree tops) may temporarily increase fire risk until that biomass decomposes.

Another important factor in reducing fire risk is removing ladder fuels. Ladder fuels are typically small trees or shrubs whose crowns are near the forest floor but whose tops extend to the base of the canopy trees. While ladder fuels present a fire risk in forests throughout the state, ladder fuels are becoming particularly problematic in the southern half of the state, where Japanese climbing fern (*Lygodium japonicum*), an invasive species that grows up the trunks and among branches of trees, continues to expand. Even though these fuels are often unmerchantable and, in the case of Japanese climbing fern, costly to remove, removing ladder fuels is critically important to reducing fire risk.

Finally, thinning can also reduce the risk of spreading crown fire. By removing trees from the canopy, thinning increases space between residual trees. This makes it more difficult for fire to spread between crowns.

Ice Storms

Severe ice storms in the South do not occur with great frequency, but when they do, they can cause incredible damage. Pine stands, and particularly recently thinned pine stands, are highly vulnerable in ice events. Because ice does most of its damage by bending branches and boles beyond their breaking point, species that retain their leaves during the winter, such as pines, are at greater risk to ice damage because their evergreen needles provide a much larger surface area for ice to accumulate. Densely stocked stands are better able to provide crown support, which should help support branches under ice and reduce stress on the main bole. Residual trees in recently thinned stands typically have smaller branches and thinner boles, resulting in a lower-fiber breaking point compared to open-grown trees of the same age. Fortunately, however, this increased susceptibility diminishes quickly after thinning once tree branches and boles increase in size and neighboring crown support returns.

Insect Pests

It has been well documented that insect damage dramatically increases in managed stands. The best known examples of this in the South are southern pine beetle (*Dendroctonus frontalis*) and ips (*Ips* spp.). Both insects are attracted to the pheromones emitted by stressed pine trees, and both achieve greater success when attacking trees under stress.

Thinning increases the resistance of your stand to attack from native boring insects through a variety of mechanisms. First, by removing trees, thinning creates a more open stand structure. This makes it more difficult for the beetles to locate stressed trees, as the pheromones are allowed to dissipate rather than being trapped beneath the canopy. Thinning also increases the amount of moisture and sunlight that penetrates a forest stand. This, in turn, stimulates decomposition, temporarily increasing nutrient availability. In addition to increasing resource supply, thinning also decreases competition for resources among residual trees. As a result, tree vigor increases throughout the stand, reducing the odds of beetle attack.

Conclusion

Trade-offs are an unfortunate reality in forest management. Rarely can we apply one treatment or plant one species to meet all of our management goals.

Thinning is no different in terms of its effectiveness in lowering risk to extreme weather. On one hand, thinning helps improve tree growth and vigor, thereby shortening timber rotations and increasing resilience to drought and boring insects. In addition, through its effect on reducing fuel loads, thinning increases resistance to fire. On the other hand, recently thinned stands are more likely to sustain damage, albeit temporarily, in a wind or ice storm.

So what should a landowner do? The answer ultimately lies in your ownership objectives, geographic location, and stand species composition. For landowners interested in producing timber, the benefits of shorter rotations, increased return on investment (ROI), and reduced risk to fire, drought, and boring insects far outweigh the temporary risks from wind and ice damage in recently thinned stands. Therefore, an increase in extreme weather events is not expected to change the forest management practice of thinning unless the balance of the risks versus benefits becomes enormously skewed in favor of denser forest stands.

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