MISSISSIPPI STATE UNIVERSITY EXTENSION

Storm-Resistant Trees for Mississippi Landscapes

Mississippi has a humid, subtropical climate. Summers are long and hot, but winters are relatively mild. Prevailing southerly winds much of the year bring warm, humid air from the Gulf of Mexico across the state. Precipitation is distributed through the year with north Mississippi receiving about 55 inches and southern Mississippi about 65 inches. Southern Mississippi experiences more thunderstorms and hurricanes than the rest of the state.

The length of the state north to south spans several cold-hardiness zones, from 7b (5–10°F average coldest temperatures) in north Mississippi to 9a (20–25°F average coldest temperatures) on the coast. Mississippi also has its share of stormy weather. These include occasional ice storms in winter; high winds from thunderstorms, hurricanes, and tornadoes; flooding from torrential rains; and storm surges from hurricanes.

While native vegetation has adapted to a wide variety of environmental conditions, some species are better able to survive storm events than others. It makes sense to choose tree species for the landscape that can withstand these natural events. Storm-resistant trees will make your property safer and reduce future tree maintenance costs. This publication provides an overview of tree species that are capable of surviving winter ice, high winds, extensive flooding, and salt spray or seawater inundation. Very few tree species are resistant to all these storm conditions, so prioritize those that are most likely to impact your landscape.

Ice Resistance

Occasional ice storms in Mississippi can be devastating to trees. Such storms occur when the polar jet stream dips south in the winter. This phenomenon is known as the "Siberian Express," and it brings arctic air and prolonged freezing temperatures to the state. If a wet warm front follows, then freezing rain and ice damage may result. In February 1994, a slow-moving front caused a severe ice storm in the Deep South—across Arkansas, Tennessee, Mississippi, and Alabama. Estimated damage was more than $3 billion, and a million people were without power, some over a month.

Figure 1. Eastern redcedar (*Juniperus virginiana*) is resistant to ice and tolerant of salt spray and saline soil. The tree can grow on a wide variety of sites, including alkaline soils. It is evergreen, and its leaves form overlapping scales.

Tree species vary in their tolerance to ice accumulation. Those species most resistant to breakage from ice generally have strong branch attachment, flexible branches, low branch surface area, and straight trunks. Ice-tolerant species having one or more of these characteristics include bald cypress (*Taxodium distichum*), black walnut (*Juglans nigra*), and eastern redcedar (*Juniperus virginiana*; Figure 1).

Wind Resistance

Severe winds from thunderstorms are common in Mississippi, occurring an average of 55 days per year in northern counties and 75 days per year in southern counties. Storms occurring in late autumn and early spring may be associated with fronts having very high winds. Indeed, tornadoes often accompany these frontal systems crossing the state. Mississippi ranks eighth nationally in the frequency of tornadoes per 10,000 square miles. Hurricanes also bring very high winds; Mississippi has experienced 19 in the state since 1851.

Tree species vary widely in their ability to tolerate high winds, and the ability of any individual tree to survive wind will also depend on its health. However, there are some characteristics that enable trees to adapt to high wind. For instance, some tree species will defoliate during extreme winds, which increases their chances of survival. These include live oak (*Quercus virginiana*; Figure 2), flowering dogwood (*Cornus florida*), and crape myrtle (*Lagerstroemia indica*). Wood characteristics, such as high wood density or high elasticity, can help trees survive high winds. Live oaks have very dense wood. Some species with open crowns or pruned canopies survive high winds better. Trees with tapered crowns, such as eastern redcedar, have survived high winds.

Flood Tolerance

Flash flooding from torrential rain can become a problem when drainage is blocked in low areas and water covers the soil. Extended periods of flooding from overflowing rivers especially during the growing season can be very damaging to trees. In August 2005, Hurricane Katrina hit the Gulf Coast. It was one of the deadliest and most damaging hurricanes on record. Although the eye made landfall over Louisiana, the storm surge inundated the Gulf Coast from Mississippi to the Florida Panhandle. New Orleans was flooded by 20 feet of water after several levees broke. Damage from Louisiana to west Florida was estimated to exceed $100 billion.

Tree species have varying tolerance to flooding. Tree roots need oxygen, and most tree species will not tolerate flooding during the growing season. In addition, individual tree age impacts tolerance to flooding. Mature, vigorously growing trees of tolerant species are best able to withstand flooding. On the other hand, tree seedlings may not survive being covered with siltation from river flooding. Bald cypress (*Taxodium distichum*; Figure 3) is an example of a flood-tolerant tree. It is a relatively slow-growing tree commonly found on wet sites near flowing streams or rivers. This deciduous conifer's needles drop in the autumn.

Salt Tolerance

Most land plants are adapted to fresh water. Since Mississippi experiences abundant rainfall through the year, saline soils are usually not a problem for our trees. However, trees in coastal counties regularly experience salt spray and seawater inundation.

When ocean waves break or high winds whip whitecaps, the atmosphere carries particles of salt. This sea spray can be

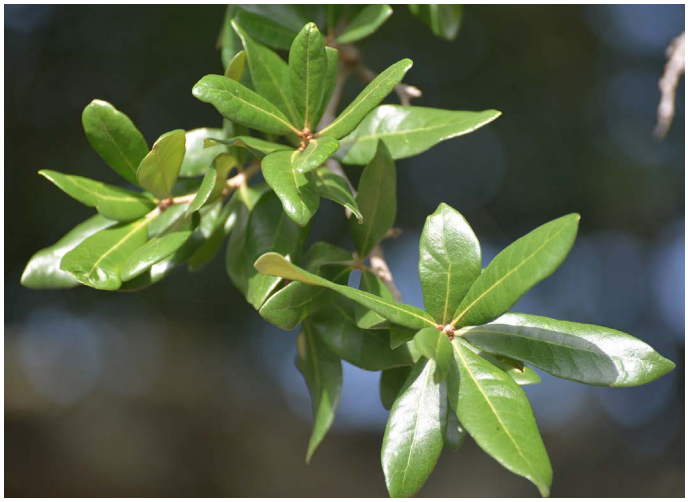

Figure 2. Live oak (*Quercus virginiana*) is highly wind resistant and tolerant of salt spray and saline soil. It has a unique form, with a spreading canopy that grows wider than tall. Its foliage is evergreen and has a thick, waxy coating.

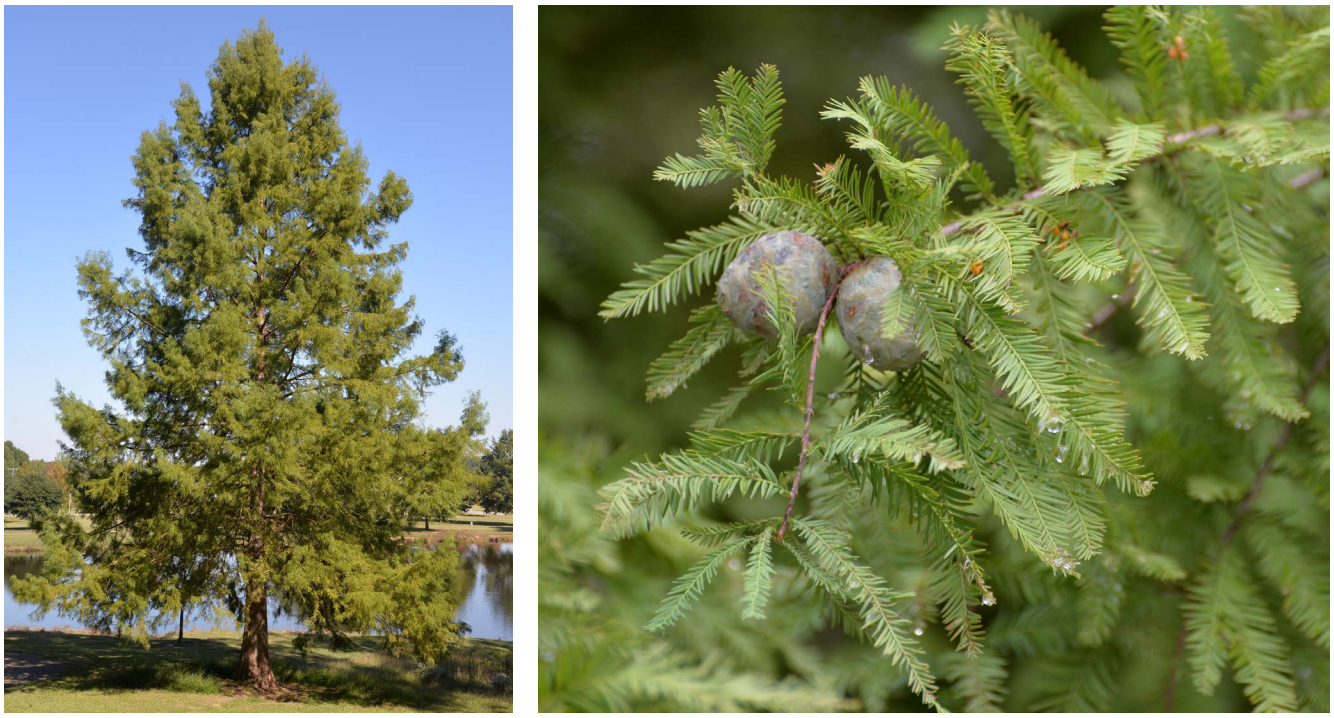

Figure 3. Bald cypress (*Taxodium distichum*) is an all-around storm-resistant tree. It is resistant to ice and wind, as well as tolerant of flooding, salt spray, and saline soil.

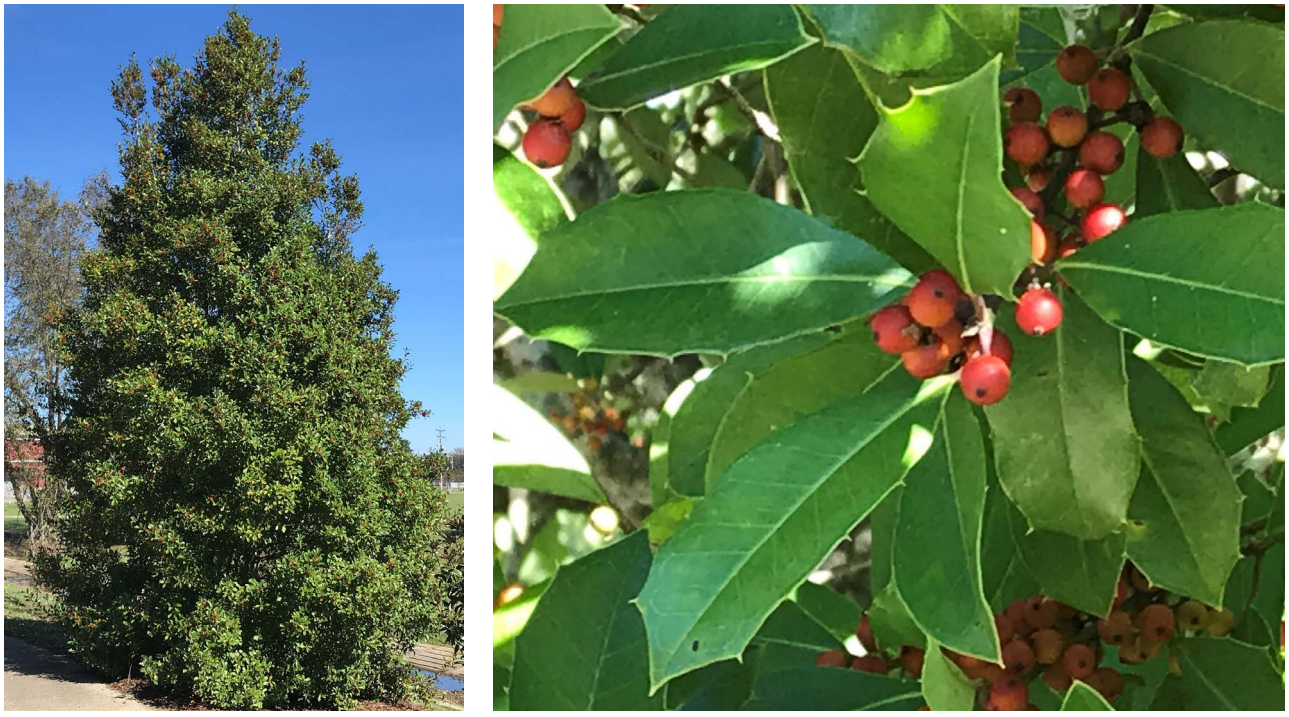

Figure 4. The American holly (*Ilex opaca*) is tolerant of salt spray and is wind resistant.

carried as far as 15 miles inland. Vegetation growing in coastal areas must be able to tolerate this salt. The sodium in salt spray or seawater can have detrimental effects on trees, including damaged or disfigured foliage, reduced growth, or even death. The American holly (*Ilex opaca*; Figure 4) is tolerant of salt spray.

The other challenge to coastal vegetation is seawater contamination of fresh water and soils, which typically occurs along coastal creeks or rivers and barrier islands. The storm surge from hurricanes or tropical storms may contaminate soils and fresh water as far as 30 miles inland. This can be a problem for forested wetlands because these areas drain slowly.

Other potential sources of salt contamination of soil and runoff include the salt used to remove ice from roads and highways and fertilizers on cultivated areas. This is usually temporary because Mississippi's abundant precipitation leaches salt through the soil. Leaching varies with soil texture and drainage, occurring more effectively in sandy soils than clay.

Too much salt in the soil can have multiple environmental effects. It can interfere with water absorption by plant roots, leading to death. High levels of salt can also degrade soil structure and lead to compaction, which decreases plant root respiration and expansion. Incorporating more organic matter into the soil can help prevent compaction. The southern magnolia (*Magnolia grandiflora*; Figure 5) tolerates saline soil and salt spray. It is an evergreen hardwood as well as the state tree and flower.

Storm-Resistant Trees

Table 1 presents relative storm resistance for established trees with well-developed root systems. Individual trees will vary in their ability to survive storm damage, so use Table 1 as a guide. The major common name for a tree is given, followed by its scientific name in italics. The taxonomy presented is in accordance with the United States Department of Agriculture, Natural Resources Conservation Service, **National PLANTS Database**. Table 1 also provides information on ice and wind resistance, as well as tolerance to flooding, salt spray, and saline soil. The book *Mississippi Trees* has photos of most of the trees on this list.

Not all trees listed will grow everywhere in Mississippi. It is important to match tree preferences with the landscape characteristics. Some species, like southern redcedar (*Juniperus virginiana* var *silicicola*) will only grow in coastal Mississippi. On the other hand, Chickasaw plum (*Prunus angustifolia*) will grow throughout most of the state except the Delta region and coastal counties.

Several tree species that are resistant to storm stresses are not necessarily suitable to plant for other reasons. Among these are green ash (*Fraxinus pennsylvanica*) and white ash (*Fraxinus americana*), which are susceptible to the emerald ash borer (EAB; *Agrilus planipennis*). Once this borer attacks an ash, the tree will die within a few years. The EAB has not yet been documented in Mississippi but has been found in all adjacent states.

Other trees have brittle wood and should not be planted near structures, driveways, or roads. These include boxelder (*Acer negundo*), eastern cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), and silver maple (*Acer saccharinum*). Finally, make sure your selected tree is not an invasive plant. Chinese tallow (*Triadica sebifera*) is wind resistant but also a nonnative invasive. If you're not sure, contact your local MSU Extension agent.

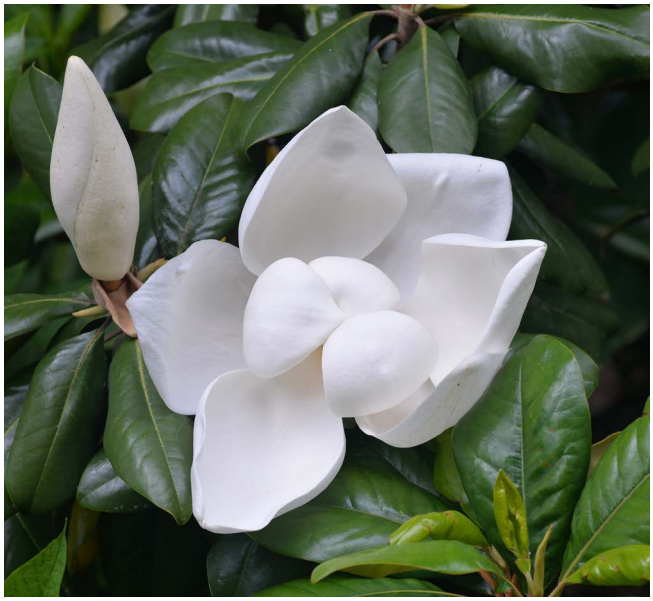

Figure 5. Southern magnolia (*Magnolia grandiflora*) tolerates both salt spray and saline soil. It is also wind resistant.

Table 1. Storm-resistant trees for Mississippi.

Tree	Species	Ice resistant[1]	Wind resistant[2]	Flood tolerant[3]	Salt spray tolerant[4]	Saline soil tolerant[4]
American beech	*Fagus grandifolia*			yes		
American holly	*Ilex opaca*		yes		yes	
American hornbeam	*Carpinus caroliniana*	yes	yes			
American sycamore	*Platanus occidentalis*		yes	yes		
American witchhazel	*Hamamelis virginiana*	yes				
Bald cypress	*Taxodium distichum*	yes	yes	yes	yes	yes
Bitternut hickory	*Carya cordiformis*	yes				
Black cherry	*Prunus serotina*				yes	
Black locust	*Robinia pseudoacacia*				yes	yes
Black walnut	*Juglans nigra*	yes			yes	yes
Black willow	*Salix nigra*			yes		
Blackgum	*Nyssa sylvatica*	yes	yes		yes	
Boxelder	*Acer negundo*			yes		
Bur oak*	*Quercus macrocarpa*	yes		yes		
Cabbage palm	*Sabal palmetto*		yes		yes	yes
Carolina laurelcherry	*Prunus caroliniana*					yes
Chaste tree*	*Vitex agnus-castus*					yes
Chickasaw plum	*Prunus angustifolia*		yes			
Chinese magnolia*	*Magnolia × soulangiana*		yes			
Common buttonbush	*Cephalanthus occidentalis*			yes		
Common persimmon	*Diospyros virginiana*		yes	yes	yes	yes
Crapemyrtle*	*Lagerstroemia indica*		yes			
Dahoon	*Ilex cassine*		yes			
Eastern cottonwood	*Populus deltoides*			yes		
Eastern redbud	*Cercis canadensis*		yes			
Eastern redcedar	*Juniperus virginiana*	yes			yes	yes
Eastern swamp privet	*Forestiera acuminata*			yes		
Farkleberry	*Vaccinium arboreum*		yes			
Flowering dogwood	*Cornus florida*		yes			
Green ash	*Fraxinus pennsylvanica*			yes	yes	
Honey locust	*Gleditsia triacanthos*			yes	yes	yes
Hophornbeam	*Ostrya virginiana*	yes	yes			
Inkberry	*Ilex glabra*		yes		yes	
Japanese maple*	*Acer palmatum*		yes			
Laurel oak	*Quercus laurifolia*		yes			
Live oak	*Quercus virginiana*		yes		yes	yes
Longleaf pine	*Pinus palustris*				yes	
Maidenhair tree[5]	*Ginkgo biloba*	yes			yes	
Mockernut hickory	*Carya tomentosa*		yes			
Myrtle oak	*Quercus myrtifolia*		yes			
Nuttall oak	*Quercus texana*			yes		
Overcup oak	*Quercus lyrata*			yes		
Pecan	*Carya illinoinensis*		yes	yes		
Pignut hickory	*Carya glabra*	yes	yes			

Tree	Species	Ice resistant[1]	Wind resistant[2]	Flood tolerant[3]	Salt spray tolerant[4]	Saline soil tolerant[4]
Pin oak	*Quercus palustris*			yes		
Planertree	*Planera aquatica*			yes		
Pond cypress	*Taxodium ascendens*		yes	yes		
Possumhaw	*Ilex decidua*			yes		
Post oak	*Quercus stellata*		yes			
Red maple	*Acer rubrum*			yes		
River birch	*Betula nigra*		yes			
Sand live oak	*Quercus geminata*		yes			
Saw palmetto	*Serenoa repens*				yes	yes
Shagbark hickory	*Carya ovata*	yes				
Shumard oak	*Quercus shumardii*		yes			
Silver maple	*Acer saccharinum*			yes		
Slash pine	*Pinus elliottii*					yes
Southern catalpa	*Catalpa bignonioides*	yes				
Southern crab apple	*Malus angustifolia*	yes	yes			
Southern magnolia	*Magnolia grandiflora*		yes		yes	yes
Southern redcedar	*Juniperus virginiana var silicicola*				yes	yes
Southern sugar maple	*Acer floridanum*		yes			
Staghorn sumac	*Rhus typhina*				yes	yes
Sugarberry	*Celtis laevigata*			yes		
Swamp chestnut oak	*Quercus michauxii*		yes			
Swamp white oak	*Quercus bicolor*	yes		yes		
Sweetbay	*Magnolia virginiana*		yes			yes
Sweetgum	*Liquidambar styraciflua*	yes	yes	yes	yes	
Turkey oak	*Quercus laevis*		yes			
Water oak	*Quercus nigra*		yes	yes		
Water hickory	*Carya aquatica*			yes		
Water locust	*Gleditsia aquatica*			yes		
Water tupelo	*Nyssa aquatica*		yes	yes		
Wax myrtle	*Morella cerifera*				yes	yes
White ash	*Fraxinus americana*		yes	yes	yes	yes
White fringetree	*Chionanthus virginicus*		yes			yes
White oak	*Quercus alba*	yes				yes
Willow oak	*Quercus phellos*			yes	yes	
Winged elm	*Ulmus alata*		yes	yes		
Yaupon	*Ilex vomitoria*		yes		yes	yes

* Non-native ornamental.

[1] Hauer, Wang, and Dawson (1993) evaluated damage to numerous species of urban trees after an ice storm by comparing to a pre-storm tree inventory. They found that tree form, strength of limb joints, and overall tree size were related to subsequent ice damage. Later, Hauer, Dawson, and Werner (2006) published a more comprehensive summary of their research on tree resistance to ice damage in urban forests. Their findings included assessments on tree species, age and form of the tree, and particularly the ability of tree branch junctures to withstand ice loads.

[2] Duryea, Kampf, and Littell (2007) and Duryea and Kampf (2017) assessed tree damage resulting from nine hurricanes in Florida and Puerto Rico between 1992 and 2004, with sustained winds between 85 and 165 miles per hour. The first assessment surveyed homeowners regarding tree damage after Hurricane Andrew in 1992. For the remaining eight hurricanes, researchers surveyed arborists, urban foresters, and forest scientists.

[3] Bratkovich, Burban, Katovich, Locey, Pokorny, and Wiest (1993) published an assessment of flooding effects on trees along the Mississippi and Missouri Rivers. Flood tolerance indicates that tree species are able to survive standing water through at least one growing season. Clatterbuck (2005) was an additional source for flood-tolerant trees.

[4] Tolerance to salt spray and seawater inundation were compiled from the following sources: Appleton, Greene, Smith, French, Kane, Fox, Downing, and Gilland (2015); Ruter and Pennisi (2017); Smith 2019.

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