

# Notes For Forest Managers

Missouri Department of Conservation



Report #5

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## Silvics of Missouri Bottomland Tree Species

The environmental conditions of bottomlands pose many challenges for reforestation and forest management. Most bottomlands are prone to flooding, which favors species that are tolerant of inundation. Sediment deposited by flood waters also favors the regeneration of species that require bare, mineral-soil seedbeds. Bottomlands also are nutrient-rich and have a high moisture supply capacity which favors species that are ecologically exploitive and fast growing.

Knowledge of ecological adaptations and environmental tolerances of tree species is especially important for reforesting and managing forests in bottomlands. For reforestation efforts, this knowledge can be used to identify tree species most suited for the soil and hydrologic conditions of the site or to identify appropriate site preparation methods required for establishing desirable tree species. For managing mature bottomland forests, this knowledge can be used to develop appropriate silvicultural disturbances needed to perpetuate a desirable forest composition.

Information about the adaptations and environmental tolerances of tree species is derived through "silvics," the study of the ecological characteristics of trees with emphasis on environmental factors. Some important silvical characteristics include shade tolerance, growth

rate, longevity, reproduction strategy, adaptability to soil and hydrologic conditions, and susceptibility to disturbances, pathogens and pests.

It is important to keep in mind that nearly all tree species achieve best growth in moist, well-drained, deep and fertile soils. However, some species are tolerant of conditions that are less than optimal. Most bottomland species are tolerant of flooded or temporarily saturated soils. This tolerance to flooding and wet soil conditions allows bottomland species to achieve relatively fast growth and therefore to be ecologically competitive in floodplains even though environmental conditions are not optimal for best growth.

This issue of *Notes For Forest Managers* provides a concise summary of important silvical characteristics of Missouri's bottomland trees. It is particularly focused on species adaptations to, or tolerances of, environmental and site conditions. It was developed by summarizing information from the seven different references cited in the text. This Note was designed to serve as a relatively comprehensive but portable field guide. More detailed information can be found in the references cited in this Note.

### ABSTRACT

This issue of *Notes For Forest Managers* provides a concise summary of important silvical characteristics of Missouri's bottomland trees. It focuses on species adaptations to, or tolerances of, environmental and site conditions. It is a compilation of information from seven different references cited in

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| Scientific Name          | Common Name       | Shade Tolerance <sup>1,2</sup> | Longevity (years) <sup>1,2,3</sup> | Growth Rate <sup>1</sup> | Fruit Type <sup>1,2</sup> ; Seed Dispersal <sup>2</sup> (dispersal time; germination time) <sup>2</sup> | Primary Reproduction Mechanisms <sup>1,2,3</sup>                              | Flood Tolerance <sup>4</sup> | Notes <sup>1,2</sup>   |
|--------------------------|-------------------|--------------------------------|------------------------------------|--------------------------|---|---|------------------------------|--|
| <i>Acer negundo</i>      | boxelder          | n/a                            | <100                               | rapid                    | samara; seed dispersed by wind, animals (fall; spring germination)                                      | primarily by seed on a variety of seedbeds; sprouts are common in young trees | tolerant                     | Boxelder is a fast-growing species in bottomlands and is most common on well-drained soils.  |
| <i>Acer rubrum</i>       | red maple         | tolerant                       | 100-200                            | moderate                 | samara; seed dispersed by wind, animals (spring; spring germination)                                    | by seed on bare soil or in leaf litter and by sprouting                       | tolerant                     | Red maple is a shade-tolerant but pioneering species that is a prolific sprouter and is resistant to herbicides.   |
| <i>Acer saccharinum</i>  | silver maple      | tolerant                       | 100-200                            | rapid                    | samara; seed dispersed by wind, animals (spring; spring germination)                                    | primarily by seed on bare soil; can produce sprouts                           | tolerant                     | This is a fast-growing species that often colonizes wet sites. It is shade intolerant on poor sites.   |
| <i>Aesculus glabra</i>   | Ohio buckeye      | tolerant                       | n/a                                | n/a                      | capsule; seed dispersed by gravity and animals (fall; spring germination)                               | n/a   | n/a                          | Buckeye is observed to be a common, slow-growing species in bottomlands.   |
| <i>Asimina triloba</i>   | pawpaw            | tolerant                       | n/a                                | n/a                      | berry; seed dispersed by gravity and animals (fall; n/a) <sup>5</sup>                                   | n/a   | intolerant                   | Pawpaw is considered an indicator of good site quality.  |
| <i>Betula nigra</i>      | river birch       | intolerant                     | <100                               | rapid                    | winged nutlet; seed dispersed by wind (spring; spring germination)                                      | primarily by seed on moist seedbeds; can produce sprouts                      | moderately tolerant          | River birch is a pioneer species with high tolerance of soils with a low pH. It is only moderately tolerant of flooding despite being a common bottomland species. |
| <i>Carya aquatica</i>    | water hickory     | moderately tolerant            | n/a                                | slow                     | husked nut; seed dispersed by water and animals (fall; spring germination)                              | by seed; sprouts readily  | moderately tolerant          | Water hickory is slow growing and found on wet, clayey soils. In Missouri, it grows in the Mississippi Alluvial Basin.   |
| <i>Carya cordiformis</i> | bitternut hickory | intolerant                     | 100-200                            | moderate                 | husked nut; seed dispersed by gravity (fall; spring germination)  | by seed and also by sprouting   | n/a                          | Bitternut hickory is generally found in moist bottomlands. Its seed is considered distasteful by wildlife.   |

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|----------------------------------|-------------------|---------------------------------|------------------------------------|--------------------------|---|---|------------------------------|--|
| <i>Carya illinoensis</i>         | pecan             | intolerant                      | n/a                                | n/a                      | husked nut; seed dispersed by water and animals (fall; spring germination)                              | primarily by seed; does produce sprouts                   | moderately tolerant          | Despite its moderate flood tolerance rating, this species survived 1993 floods better than many others; it is common on wet, clayey soils.                             |
| <i>Carya laciniosa</i>           | shellbark hickory | tolerant                        | >200                               | slow                     | husked nut; seed dispersed by animals (fall; spring germination)  | primarily by seed in moist soil; readily produces sprouts | n/a                          | This is a bottomland species that also can be found in uplands. Shellbark hickory requires greater soil moisture than other hickories and is common in north Missouri. |
| <i>Carya ovata</i>               | shagbark hickory  | moderately tolerant             | >200                               | moderate                 | husked nut; seed dispersed by animals (fall; spring germination)  | by seed and by sprouting                                  | intolerant                   | This is a long-lived, slow-growing species that occurs on a variety of sites.  |
| <i>Catalpa speciosa</i>          | catalpa           | n/a                             | n/a                                | n/a                      | large capsule containing flat seeds (n/a)   | n/a   | moderately tolerant          | This species is originally native to southeast Missouri bottomlands.   |
| <i>Celtis laevigata</i>          | sugarberry        | tolerant                        | 100-200                            | moderate to rapid        | drupe; seed dispersed by water and animals (fall/winter; spring germination)                            | primarily by seed; only small trees produce sprouts       | moderately tolerant          | Sugarberry is found in moist sites, especially bottomlands, and is relatively more common in southern Missouri.  |
| <i>Celtis occidentalis</i>       | hackberry         | moderately tolerant to tolerant | 100-200                            | rapid                    | drupe; seed dispersed by water and animals (fall/winter; spring germination)                            | primarily by seed; only small trees produce sprouts       | tolerant                     | Hackberry is found in bottomlands and uplands nearly throughout the state.   |
| <i>Cephalanthus occidentalis</i> | buttonbush        | n/a                             | n/a                                | n/a                      | cluster of nutlets?; seed dispersed by animals (fall; n/a)  | primarily by seed   | very tolerant                | Buttonbush is found in swampy bottomlands along streams, oxbows and ponds. <sup>6</sup>  |
| <i>Crataegus</i> spp.            | hawthorn          | n/a                             | n/a                                | n/a                      | nutlet?; seed dispersed by animals (fall; n/a)  | primarily by seed   | moderately tolerant          | n/a  |
| <i>Diospyros virginiana</i>      | persimmon         | tolerant                        | n/a                                | slow                     | berry; seed dispersed by animals and water (fall; spring germination)                                   | primarily by seed; readily produces sprouts               | tolerant                     | Persimmon is a slow-growing, shade-tolerant and flood-tolerant bottomland species that commonly invades abandoned fields.  |

n/a — information not available

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|--------------------------------|----------------------|-----------------------------------|------------------------------------|--------------------------|---|---|------------------------------|--|
| <i>Fraxinus pennsylvanica</i>  | green ash            | moderately tolerant to intolerant | 100-200                            | rapid                    | samara; seed dispersed by wind and water (fall; spring germination)                                     | primarily by seed; readily produces sprouts   | very tolerant                | This species is fast growing and flood tolerant and pioneers in bottomlands, drainages and old fields.   |
| <i>Fraxinus profunda</i>       | pumpkin ash          | moderately tolerant               | n/a                                | n/a                      | samara; seed dispersed by wind and water (fall; spring germination)                                     | primarily by seed on bare, moist soil; readily produces sprouts   | very tolerant                | Pumpkin ash occurs on wet or very wet sites in the Mississippi Alluvial Basin.   |
| <i>Gleditsia triacanthos</i>   | honeylocust          | intolerant                        | 100-200                            | moderate                 | legume; seed dispersed by animals (fall; spring germination)  | primarily by seed (Germination is enhanced when seed is softened by passing through an animal's digestive system); produces sprouts readily | moderately tolerant          | Honeylocust is a moderately fast-growing bottomland species that commonly invades abandoned fields.  |
| <i>Ilex decidua</i>            | deciduous holly      | n/a                               | n/a                                | n/a                      | drupe; seed dispersed by animals (fall; n/a)  | n/a   | very tolerant                | This species occurs on a variety of sites, from uplands to bottomlands. <sup>6</sup>   |
| <i>Ilex opaca</i>              | American holly       | tolerant                          | 100-200                            | slow                     | drupe; seed dispersed by animals (fall; n/a)  | primarily by seed; does produce sprouts   | intolerant                   | American holly occurs on a variety of sites from uplands to bottomlands that do not flood frequently. In Missouri, it is native to the Mississippi Alluvial Basin. |
| <i>Juglans nigra</i>           | eastern black walnut | intolerant                        | 100-200                            | rapid                    | husked nut; seed dispersed by animals (fall; spring germination)  | primarily by seed; does produce sprouts   | intolerant                   | Eastern black walnut has scattered occurrence in moist, well-drained upland or bottomland soils.   |
| <i>Juniperus virginiana</i>    | eastern redcedar     | intolerant                        | >300                               | slow                     | seeds in berry-like cone dispersed by animals; seeds require 2-3 years to germinate                     | this species naturally regenerates by seed and does not produce sprouts   | intolerant                   | Because of its slow growth rate and shade intolerance, this species is often limited to poor sites and abandoned fields.   |
| <i>Liquidambar styraciflua</i> | sweetgum             | intolerant                        | >300                               | rapid                    | seeds in ball of winged capsules and are dispersed by wind (fall; spring germination)                   | by seed and by sprouts; it is considered a prolific sprouter  | tolerant                     | Sweetgum is common, fast growing, shade intolerant and flood tolerant. It occurs in bottomlands in southeast Missouri.   |

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|--|--------------------|--------------------------------|------------------------------------|--------------------------|---|---|------------------------------|---|
| <i>Morus rubra</i>                           | red mulberry       | tolerant                       | n/a                                | rapid                    | berry containing drupelets; seed dispersed by animals (summer; spring germination)                      | primarily by seed; it is considered a prolific sprouter   | moderately tolerant          | Mulberry is a fast-growing tree in valleys, floodplains and moist hillslopes.   |
| <i>Nyssa aquatica</i>                        | water tupelo       | intolerant                     | n/a                                | n/a                      | drupe; seed dispersed by water (winter; spring germination)   | primarily by seed and seedling development is best in saturated soil or in aerated standing water; it is considered a prolific sprouter | very tolerant                | This is a large, long-lived tree growing in bottomlands or swamps where its root system is periodically under water.  |
| <i>Nyssa sylvatica</i> var. <i>sylvatica</i> | blackgum           | tolerant                       | n/a                                | slow to moderate         | drupe; dispersed by animals (fall; spring germination)  | by seed and by sprouting  | tolerant                     | There are two varieties of <i>Nyssa sylvatica</i> . Variety <i>sylvatica</i> , commonly called “blackgum,” is found in a range of sites in southern Missouri.                             |
| <i>Platanus occidentalis</i>                 | sycamore           | moderately tolerant            | >300                               | rapid                    | “ball” of achenes; seed dispersed by wind, water and animals (winter-early spring; spring germination)  | primarily by seed on bare, moist soil; readily produces sprouts   | tolerant                     | Sycamore is a fast-growing, flood-tolerant and long-lived species of bottomlands. It naturally regenerates on mudflats and bare sand after flood waters have receded.                     |
| <i>Populus deltoides</i>                     | eastern cottonwood | very tolerant                  | generally <100                     | rapid                    | seeds in capsules; seed dispersed by wind and water (spring; spring germination)                        | primarily by seed on bare, moist soil; small trees readily produce sprouts  | very tolerant                | Eastern cottonwood is a fast-growing, short-lived pioneer species common in bottomlands. It is a prolific seed producer and its seeds require moist exposed mineral soil for germination. |
| <i>Quercus alba</i>                          | white oak          | moderately tolerant            | >300                               | slow to moderate         | nut; dispersed by animals (fall; fall germination)  | by seed and by producing sprouts; sprouting more likely on trees <15" d.b.h.  | intolerant                   | White oak is most commonly an upland species although it occurs on well-drained terraces that rarely flood. It is moderate in growth rate and shade tolerance, and is long-lived.         |

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|---------------------------|--------------------|--------------------------------|------------------------------------|--------------------------|---|--|------------------------------|--|
| <i>Quercus bicolor</i>    | swamp white oak    | moderately tolerant            | >300                               | rapid                    | nut; dispersed by animals (fall; fall germination)  | by seed and by producing sprouts; sprouting more likely on trees <15" d.b.h.                               | tolerant                     | Swamp white oak is a fast-growing, long-lived, flood-tolerant species common, but not abundant, in central and north Missouri in bottomlands and poorly-drained uplands. Its sweet acorn is sought by deer.  |
| <i>Quercus lyrata</i>     | overcup oak        | moderately tolerant            | >300                               | slow                     | nut; dispersed by animals and water (fall; one of few white oak group species having acorns that germinate in the spring) | primarily by seed in the spring after flood waters have receded; sprouting occurs but it is not consistent | tolerant                     | Overcup oak is a slow-growing but flood-tolerant bottomland species in poorly-drained floodplains in the Mississippi Alluvial Basin and along the Mississippi River valley to just north of St. Louis. Its acorns are less preferred by wildlife than acorns of other oaks.    |
| <i>Quercus macrocarpa</i> | bur oak            | moderately tolerant            | >300                               | slow                     | nut; dispersed by animals (fall; fall-spring germination)   | by seed and by sprouts   | tolerant                     | Bur oak is a slow-growing, flood-tolerant species that, in Missouri, occurs in moderately well- to well-drained soils.   |
| <i>Quercus michauxii</i>  | swamp chestnut oak | intolerant                     | n/a                                | n/a                      | nut; dispersed by animals (fall; fall germination)  | primarily by seed; sprouts, but not prolifically   | intolerant                   | Despite its name, swamp chestnut is intolerant of flooding and is generally found in bottomlands having well-drained soils. In Missouri, it occurs in the Mississippi Alluvial Basin. In the south, it is found with cherrybark oak. It is valued for its high quality timber. |
| <i>Quercus nigra</i>      | water oak          | intolerant                     | n/a                                | rapid                    | nut; dispersed by water and animals (fall; spring germination)  | primarily by seed; no information about sprouting was found  | tolerant                     | In Missouri, water oak is a fast-growing, flood-tolerant species in poorly- to well-drained bottomlands in the Mississippi Alluvial Basin.   |
| <i>Quercus texana</i>     | Nuttall oak        | intolerant                     | n/a                                | rapid                    | nut; dispersed by animals (fall; spring germination)  | primarily by seed; small trees readily produce sprouts   | tolerant                     | In Missouri, Nuttall oak is flood tolerant and occurs in clayey, poorly-drained soils in the Mississippi Alluvial Basin. It is easily confused with pin oak. This species is important for wildlife because of its heavy mast production.                                      |

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|---|--------------|--------------------------------|------------------------------------|--------------------------------|--|--|------------------------------|--|
| <i>Quercus palustris</i>                        | pin oak      | intolerant                     | 100+                               | rapid                          | nut; dispersed by animals (fall; spring germination); nuts have a waxy coating that allows them to be submerged for more than six months | primarily by seed and seedling establishment is more successful on scarified soil; readily produces sprouts                | moderately tolerant          | Pin oak is a fast-growing species occurring in bottomlands and moist uplands. It is only intermediately flood tolerant despite being common on poorly-drained, clayey soils. It is valued for waterfowl and wildlife food because its small acorns.  |
| <i>Quercus phellos</i>                          | willow oak   | intolerant                     | n/a                                | rapid                          | nut; dispersed by animals and water (fall; spring germination)   | primarily by sprouts; also by seed, and germination is best in moist, well-aerated soil having some leaf litter            | tolerant                     | Willow oak is a fast-growing species occurring in bottomlands of the Mississippi Alluvial Basin. It is desirable for wildlife because it produces a heavy annual acorn crop. Optimum growth is achieved at water table depths between 1 and 3 ft. Standing water does not decrease growth. |
| <i>Quercus shumardii</i>                        | Shumard oak  | intolerant                     | n/a                                | moderate to rapid              | nut; dispersed by animals (fall; spring germination)   | primarily by seed; information about sprouting was not available   | moderately tolerant          | Shumard oak occurs as individuals on river terraces, small-stream floodplains and on adjacent bluffs. It is tolerant of high soil pH.  |
| <i>Salix nigra</i>                              | black willow | very intolerant                | <100                               | rapid                          | capsule containing silky-haired seed; seed dispersed by wind and water (spring; spring germination)                                      | primarily by seed on moist, mineral soil seed bed; produces sprouts prolifically   | very tolerant                | This very flood-tolerant, light-seeded species requires extremely moist soils for seed germination. Because of this it occurs naturally along streams and rivers.  |
| <i>Taxodium distichum</i> var. <i>distichum</i> | baldecypress | n/a                            | >300                               | slow                           | seeds in cones; seed dispersed by gravity (winter; spring germination)   | by seed and by sprouts; reproduction by seed is persistent but not wide-spread and it requires moist soils for germination | very tolerant                | This deciduous conifer grows in moist or flooded soils in the Mississippi Alluvial Basin.  |
| <i>Ulmus alata</i>                              | winged elm   | moderately tolerant            | n/a                                | slow in forests; rapid in open | samara; seed dispersed by wind and water (spring; spring germination)  | primarily by seed; no information about sprouting was available  | tolerant                     | This species occurs on a variety of sites having soils ranging from dry to moist. It is the least shade tolerant of native elms.   |



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|------------------------|--------------|--------------------------------|------------------------------------|--------------------------|---|---|------------------------------|--|
| <i>Ulmus americana</i> | American elm | moderately tolerant            | 100-200                            | moderate                 | samara; seed dispersed by wind and water (spring; spring germination)                                   | by seed and seeds can germinate on moist litter, moss and decayed logs but do best on mineral soil; readily produces sprouts  | tolerant                     | American elm is common in, but not restricted to, bottomlands. In central and northern Missouri, it invades old fields. It is very susceptible to Dutch Elm Disease.                                 |
| <i>Ulmus rubra</i>     | slippery elm | tolerant                       | n/a                                | moderate                 | samara; seed dispersed by wind (spring; spring germination)   | by seed and seeds can germinate on moist litter, moss, and decayed logs but do best on mineral soil; readily produces sprouts | n/a                          | Slippery elm has best growth on moist, rich bottomland soils, but is also found on dry soils that are shallow to limestone. It does not reproduce or grow well if flooding is frequent or prolonged. |

<sup>1</sup> Burns, R.M., and B.H. Honkala, tech. coords. 1990. Silvics of North America: 1 Conifers; 2 Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC.

<sup>2</sup> Harlow, W.M., E.S. Harrar, and F.M. White. 1979. Textbook of dendrology, 6th ed. McGraw-Hill, New York. 510 p.

<sup>3</sup> Hicks, R.R. 1998. Ecology and silviculture of the Central Hardwoods. John Wiley and Sons, New York. 412 p.

<sup>4</sup> Teskey, R.O. and T.M. Hinckley. 1977. Impact of Water Level Changes on Woody Riparian and Wetland Communities: 2 The southern forest region; 3 The central forest region. U.S. Department of the Interior, Fish and Wildlife Service, Columbia, Mo.

<sup>5</sup> Settergren, C., and R.E. McDermott. 1983. Trees of Missouri. Univ. of Missouri Ag. Exp. Sta. Columbia, Mo. 123 p.

<sup>6</sup> Steyermark, J.A. 1996. Flora of Missouri, 7th printing. Iowa State University Press, Ames, Iowa. 1728 p.

<sup>7</sup> Kurz, D. 1997. Shrubs and woody vines of Missouri. Missouri Department of Conservation. 387 p.

## Definitions

There are several descriptive terms used to describe the silvical characteristics of trees. The following definitions apply to the information within this Note.

**Shade Tolerance** — Refers to the capacity or ability to compete or survive under shaded conditions. The descriptive ranking used here includes very tolerant, tolerant, moderately tolerant, intolerant and very intolerant.

**Longevity** — Refers to the expected life span of a tree species under normal growing conditions.

**Growth Rate** — Refers to the height and diameter growth of the species. The descriptive ranking used here includes slow, moderate and rapid.

**Fruit Type, Seed Dispersal (dispersal time; germination time)** — Refers to the kind of fruit or fruiting body that bears seed(s) and the mechanism(s) for spreading the seed. Fruit types of Missouri's bottomland species include achenes, berries, capsules, cones, drupes, legumes, nuts and samaras. Dispersal time refers to the season during which the mature fruiting body or seed is released and germination time is the time of year when the seed actually germinates.

**Primary Reproduction Mechanisms** — Refers to whether regeneration is by seed, or by producing a shoot from injured or cut stump or root. Information about seedbed requirements is

included if available. Sprouting information is included because it plays an important role for the regeneration of many species. For many species, the potential to produce sprouts decreases with increasing plant age and stem diameter.

**Flood Tolerance** — Refers to the ability to withstand flooding. The ranking used here is: Very tolerant - species that can withstand flooding for periods of two or more growing seasons; Tolerant - species that can withstand flooding for one growing season; Moderately tolerant - species that can survive growing season flooding lasting one to three months; Intolerant - species that cannot withstand growing season flooding.