Ecological Forestry Practices for Bottomland Forests of the Southeastern U.S.

Bottomland and Swamp Forest Symposium
Wilmington, North Carolina
November 1, 2017

Amanda Mahaffey
Northeast Region Director
Forest Stewards Guild

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Symposium Recap

Tuesday

- Panel of Southern States
- Policies and Partnerships
- History of Research
- Water Quality and Regulatory Issues
- Bonus: Dendroclimatology

Wednesday

- Extent of the resource
- Ecology
- Cypress-Tupelo & Harvesting
- Restoration & Artificial Regen
- NC Coastal Plain Survey
- Ancient Bald Cypress
- Stakeholder Panel

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What's left to talk about?!

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What's left to talk about?!

- Ecological Forestry in Bottomland Hardwood Forests of the Southeastern United States
- The Ecological and Economic Values of Bottomland and Swamp Hardwoods
- Field trips!

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- Research
- Training
- Education
- Outreach
- Policy analysis
- Stewardship
- Support
- Community

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http://www.forestguild.org/southeast

- 35+ pages:
- Background on bottomland hardwood forests in the Southeast
- General guidelines and specific recommendations for bottomland hardwood forest management practices
- Synthesis of science and practice (and more questions!)

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http://www.forestguild.org/southeast

The Forest Stewards Guild would like to acknowledge the members of our bottomland hardwoods working group, field forum participants, and reviewers, including Devendra Amatya, Danielle Atkinson, Alex Finkral, Brent Frey, Larry Fuller, Jim Gregory, Wade Harrison, Brad Hutnik, Joe James, Bob Kellison, Justin LaMountain, Duck Locascio, Mark Megalos, Stephen Montgomery, Joe Schwartz, John Simpson, Jim Slye, Jeremy Whigham, Bruce White, Fred White, and David Whitehouse. **This report would not have been possible without their contributions.**

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Bottomland Forests:

- Why are they important?
- Where are they?
- What are they?
- Threats
- Silviculture
- Recommendations
- Questions

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Why are bottomland hardwood forests important?

- Clean water
- Reducing the risk and severity of flooding
- Productive habitats for animals ranging from beetles to black bears
- Forest products
- Carbon storage
- Recreation

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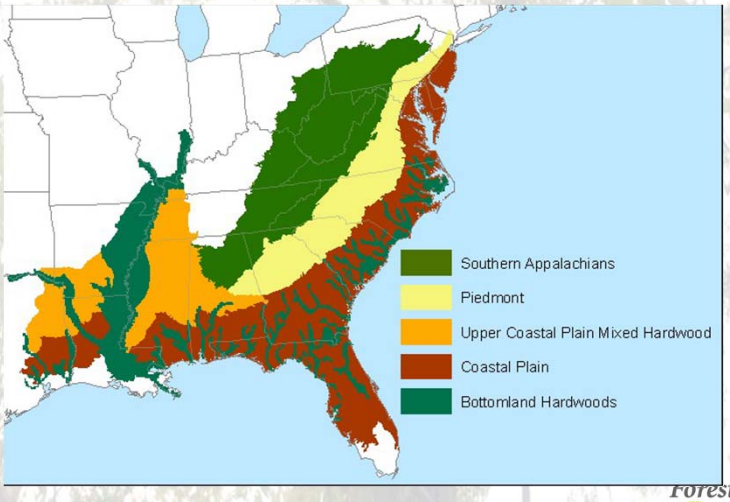
Where are bottomland hardwood forests?



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What are bottomland hardwood forests? Recommended Reading

ELSEVIER

Forest Ecology and Management 90 (1997) 117–125

Forest Ecology and Management

Development and ecology of bottomland hardwood sites

John D. Hodges

Department of Forestry, Mississippi State University, Center For Forestry and Wildlife Research, Box 9681, Mississippi, MS 39762, USA

Abstract

A basic knowledge of the origin, development, and ecology of bottomland hardwood sites is important for assessing harvesting impacts on those sites. This paper presents an overview of the geologic origin and development of hardwood sites, species–site relationships and the natural patterns of ecological succession on those sites, and the implications of that information for forest management. Bottomland hardwoods occur on floodplain sites primarily in the Atlantic and Gulf Coastal Plains. Past geologic events led to the formation of broad stream valleys in those areas because of the erodible, sedimentary geologic materials. Natural patterns of ecological succession on floodplain sites are influenced by autogenic and allogenic processes in that the sites may undergo constant change because of deposition. Three natural patterns of succession are recognized for floodplain sites of major river bottoms—those occurring on permanently flooded sites, those on low elevation wet sites, and those on higher elevation, better drained sites. Floristic composition and successional patterns are strongly influenced by the hydrologic events on the sites and particularly by rates and types of deposition.

Keywords: Floodplain geology; Hydrology; Succession; Species–site relationships

1. Origin and development of bottomland sites

1.1. Definition

All topographic positions within the Coastal Plain can be classified as either upland, floodplain, or

1.2. Occurrence and origin

Alluvial floodplains can occur along most streams of the US, but they are most common and are most extensive in the Atlantic Coastal Plain, East Gulf Coastal Plain, Mississippi Alluvial Plain, and West

Hodges, J. D. 1997. Development and ecology of bottomland hardwood sites. Forest Ecology and Management 90(2–3):117-125.

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What are bottomland hardwood forests?

- Floodplain forests
- Alluvial soils
- Hydrology-driven
- Minute elevation
- Dynamic ecosystems

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Hardwood Site Type	Surface Water Classification	Indicator Species
Muck Swamp Broad expanses between tidewater and upstream runs and along black rivers and branch bottom stands, also in areas of organic matter accumulation in red rivers and branch bottoms.	Flooded 10 to 12 months	Baldcypress, tupelo
Red river bottom Floodplain of major drainage system originating in the Piedmont or Mountains.	Flooded winter, spring	Sycamore, sweetgum, cherrybark oak
Black river bottom Floodplain of major water system originating in the Coastal Plain.	Flooded winter, spring	Tupelo, swamp black gum
Branch bottom Relatively flat, alluvial land along minor drainage system which is subject to minor overflow.	Boggy throughout year	Swamp black gum

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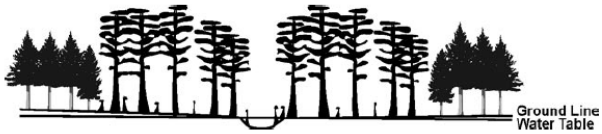
Cypress strand Low areas in south Georgia and northern Florida where shallow water flows during the wet season above the hardpan, which is usually present. Cypress forests in these strands are usually open with sedges beneath. The values for pH and available nutrients are generally low.	Flooded winter, spring, summer	Baldcypress
Cypress dome Isolated peaty acid depression (dome) usually found in Florida, which is moist or inundated for weeks or months at a time. Ground cover is usually absent except on hummocks, and the tallest trees occur in the center of the domes.	Flooded throughout year	Pondcypress, baldcypress
Piedmont bottomland In lower Piedmont, identical to red river bottom; upstream, however, features decrease in frequency and area until only well-drained bottomland is encountered.	Flooded winter	Yellow-poplar, sweetgum



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Why are bottomland hardwood forests threatened?

Chief threats include:

- Land conversion
- Economic drivers
- Climate change
- Invasive species
- (Mis)management practices

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Forest type conversion

- Agriculture
- Flood control - levees
- Development
- Insufficient CWA protection
- Conversion to intensively-managed pine plantations

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Potential for continued land use change

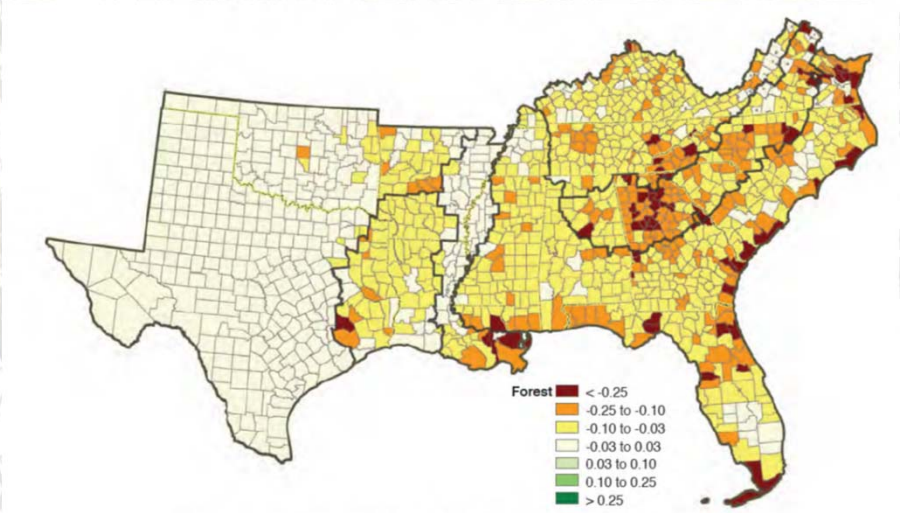

Figure 4.11—Percentage change in forest land uses, 1997 to 2060, based on an expectation of large urbanization gains and decreasing timber prices (Cornerstone B).

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Economic drivers

- High-grading ↓?
- Hardwood pulp markets ↓
- Wood pellets ↑
- Sawlog markets ↓
- Hunting leases ?

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Climate change = "Global weirdening"

- Temperatures ↑
- Drought ↑
- Precipitation in the form of more extreme weather events ↑
  - Hugo - wind
  - Joaquin – rain
- Saltwater inundation ↑
- Predictability ↓

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Invasive species

Invasive species

Most annoying

The Bruce White Scale

Least annoying

Most problematic in NC

- Chinese Privet
- Japanese stiltgrass (*Microstegium*)
- Nonnative Rose (multiflora)
- Autumn Olive (*Eleagnus*)
- Wisteria
- Bradford Pear
- Tallow Tree/Popcorn Tree

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Invasive species

Photo: UFL extension leaflet, photo credit USDA

Others to consider:

- Tufted knotweed
- Mile-a-minute weed
- Garlic mustard
- Mimosa trees
- Kudzu
- Asian bittersweet
- Cogon grass
- Japanese stiltgrass

Also:

- Emerald Ash Borer
- Feral hogs
- ?

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(Mis)management practices

- Upland silviculture in bottomlands
- Hydrologic alteration

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Threat or Opportunity: New Markets

- Forest bioenergy could grow by 100% by 2050
- Markets for low-grade wood
- Opportunity to drive ecological management
- Challenge of threats to bottomlands

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Bottomland Forests:

- Why are they important?
- Where are they?
- What are they?
- Threats
- **Silviculture**
- **Recommendations**
- **Questions**

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Silviculture

- Regeneration Treatments
- Intermediate Treatments
- Restoration
- Harvesting Operations and Hydrologic Impacts
- Red River Bottoms
- Black River Bottoms

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Silviculture

- Basics of silviculture apply: start with site evaluation before prescribing treatment
- Baker-Broadfoot method and other resources helpful for guiding restoration
- High-quality stands may be managed; poor-quality stands may be regenerated

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Regeneration Treatments

Need:

- Seed Source
- Timing
- Light
- Favorable hydrology
- Silvics

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Regeneration Treatments

Silvicultural Treatment	Advantages	Disadvantages
Clearcut An even-aged regeneration system in which essentially all the trees in a stand are removed in a single entry. Regeneration may derive from sprouts, advanced regeneration, or seedling reproduction. Shade-intolerant species show fastest initial growth.	(+) Relatively simple to implement operationally (+) Often effective way to "restart" degraded stands with a more desirable species mix (+) Treatment area of 20 acres can balance silvicultural and aesthetic goals	(-) Visual impact (-) Significant alteration to wildlife habitat (-) Potential alteration of hydrologic patterns (-) Great variation in minimum economically-viable clearcut size
Patch clearcut Clearcuts implemented in noncontiguous patches approximately two to five acres. Edges limit growth of shade-intolerant trees.	(+) Less visually intrusive than a full clearcut	(-) Requires frequent stand entry (-) May not create optimal wildlife habitat
Shelterwood cut An even-aged regeneration method that reduces the overstory canopy by approximately 50 percent in the first entry and completely within ten years. The high shade that results favors more shade-tolerant seedlings and sprouts.	(+) Less hydrologic alteration (+) In some systems, can be effective for oak regeneration	(-) Appropriate harvesting equipment and operator care are required to implement treatment with minimal disturbance to the residual stand

Silvicultural strategies for southern bottomland hardwood forests per Hicks and others

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Regeneration Treatments

Silvicultural Treatment	Advantages	Disadvantages
Seed-tree cut Seed-tree regeneration cuts involve the removal of all but a few trees retained for seed source. Favors light-seeded species establishment.	(+) Seed trees provide wildlife, ecological, and aesthetic values	(-) Most trees in floodplain systems regenerate successfully through means other than gravity-borne seed dispersal (i.e. sprouts, dispersal via water or fauna)
Two-aged system Also called leave-tree cutting, but still considered an even-aged regeneration system. 20-30 square feet per acre of basal area are retained until the end of the following rotation; at that time, 75 percent of the basal area of the regenerated stand is removed along with the leave trees.	(+) An overstory is present through all stages of stand development (+) Crop trees can be retained for the next cutting cycle (+) Requires relatively few entries on wet sites	(-) Leave trees are vulnerable to windthrow and epicormic branching
Group selection This uneven-aged regeneration treatment involves the removal of desirable and undesirable trees of similar age, size, or species within a 0.25-3.0-acre area. Similar to patch clearcuts, but with smaller holes in the canopy.	(+) Limited visual impact (+) Retained forest structure benefits wildlife	(-) Frequent entries may be impractical to implement and/or damaging to sensitive soils (-) May not favor desired shade-intolerant or mid-tolerant species
Single-tree selection Removal of individual trees in a stand to provide growing space for uneven-aged regeneration. Favors shade-tolerant species.	(+) Visually non-intrusive (+) Retained forest structure benefits some wildlife species	(-) Very difficult to apply in practice without increasing potential site damage (-) Often results in a selective or diameter-limit cut

Silvicultural strategies for southern bottomland hardwood forests per Hicks and others

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Regeneration Treatments

Species Association and Site Preference	Silvicultural System	Species Favored
Cypress-water tupelo Swamp in major bottoms; slough in minor bottoms	Group selection	Baldcypress, water tupelo, sometimes green ash, overcup oak, bitter pecan
	Clearcut	Baldcypress, water tupelo, sometimes green ash, overcup oak, bitter pecan, or elm and maple
Elm-ash-sugarberry Wide flats in major bottoms	Clearcut or group selection	Elm, green ash, sugarberry, Nuttall oak, willow oak
Sweetgum-red oaks Ridges in major bottoms; high flats in minor bottoms	Patch clearcut	Sweetgum, red oaks, green ash
	Clearcut	Sweetgum, red oaks, and green ash favored, with sweetgum favored the most
	Shelterwood	Red oaks, sweetgum, green ash
Red oaks-white oaks[2] Second bottoms, high ridges in major bottoms; terrace in minor bottoms	Shelterwood or group selection	Red oaks, white oaks, hickory, green ash, sweetgum, American hornbeam

Excerpts from Meadows and Stanturf (1997)

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Intermediate Treatments

Silvicultural Treatment	Advantages	Disadvantages
Intermediate thinning	(+) Provides periodic economic income (+) Enhances wildlife habitat (+) Increases growth rates of timber and value	(-) Requires expertise to pan and implement (-) Appropriate harvesting equipment and operator care are required to minimize damage to residual stand and site

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Intermediate Treatments

"In southern hardwoods, thinnings often become economically feasible at about 30-50 years in an even-aged stand, with a thinning repeated every 10-15 years until rotation harvest at 60-100 years. Good practitioners always use improvement thinnings to achieve the landowner's objectives. Periodic thinnings in both even- and uneven-aged systems provide periodic income to the landowner and cannot be ignored. The intermediate treatments provide land managers with the opportunity to use the culture in silviculture to shape the stand into the desired condition to provide the future benefits being managed for. Growth in timber volume and value, wildlife habitat, and other objectives can be significantly increased with application of improvement thinnings over the life of a stand."

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Restoration

Restoring hydrologic function is the key to restoring bottomland hardwood ecosystems

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Harvesting Operations and Hydrologic Impacts: Tip #1

Study site hydrology before, during, and after harvest.

- "Poor drainage is a silent killer. Stagnant, hot water can prevent desirable regeneration on a site."
- "Late spring and early summer is the worst time for bottomland species encountering impounded conditions because the impounded water temperature increases, which impedes seed germination, sprout regeneration and plant growth."
- Simple monitoring can be done with photos, cheap plastic rain gauges, or consultation with a hydrologist.

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Harvesting Operations and Hydrologic Impacts: Tip #2

BMPs for water quality can also protect hydrologic function. Applicable BMPs from FL and NC:

- Work with loggers to plan your harvest and minimize activity in sensitive or exceptionally wet areas.
- Protect ditchbanks and ephemeral streambanks.
- Put in culverts, dips, bridges, or box culverts in roads to enable water flow. Build in fencing features around culverts and drainage areas to prevent backup of logging slash and debris.
- Reduce evapotranspiration by harvesting smaller areas or maintaining residual trees and canopy cover. This protects hydrologic functions as well as a seed source.

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Harvesting Operations and Hydrologic Impacts: Tip #3

Help the ecosystem to adapt to the new "normal" after a harvest.

- Minimize human alteration
  - Soil compaction
  - Rutting, churning
  - Wet-weather harvesting
- Consider intensity and frequency of local weather events Prepare the stand to be resilient in the event of significant hydrologic change

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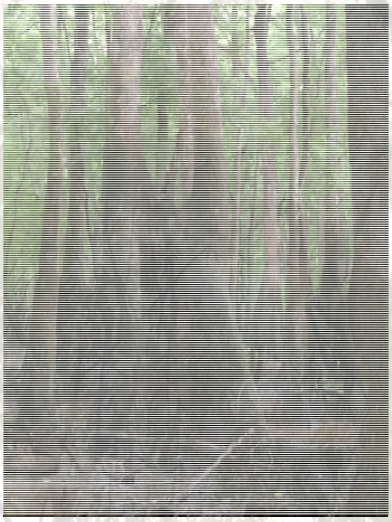
Recommendations: Biodiversity



- "Wildlife forestry" can = income from hunting leases
- Many species prefer a complex understory and midstory
- Retain dominant trees, coarse woody material, and cavity trees
- Retain microhabitat features

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Recommendations: Conservation

- Conservation can be a tool for management
- For some places and natural communities, the highest management priority may be protection through a working forest conservation easement or outright preservation

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Recommendations: Red River Bottoms

Red river bottom Floodplain of major drainage system originating in the Piedmont or Mountains.	Flooded winter, spring	Sycamore, sweetgum, cherrybark oak

- Harvesting a mature stand of hardwoods in red river bottoms will favor pioneer even if oaks are present in the overstory.
- To promote oaks on these sites, plan for longer rotations to allow the shade- and mid-tolerant oaks to gain a competitive advantage.

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Recommendations: Red River Bottoms

Red river bottom Floodplain of major drainage system originating in the Piedmont or Mountains.	Flooded winter, spring	Sycamore, sweetgum, cherrybark oak

- Consider silvicultural treatments such as shelterwood harvests or patch cuts
- Bottomland red oaks given some direct sunlight during early stand development will eventually surpass other species

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Recommendations: Black River Bottoms

Black river bottom Floodplain of major water system originating in the Coastal Plain.	Flooded winter, spring	Tupelo, swamp black gum

- Keep in mind that soils in black river bottoms originate in the coastal plain and are less nutrient-rich than those of red
- river systems. Stands dominated by tupelo gum, swamp blackgum, cypress, Carolina ash, and similar species will regenerate largely by sprout origin

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Recommendations: Black River Bottoms

Black river bottom	Flooded winter, spring	Tupelo, swamp black gum
Floodplain of major water system originating in the Coastal Plain.		

- Cutting stumps low (10 to 14 inches) and harvesting while trees are dormant are also recommended for encouraging coppice
- Group selection or patch cuts can be used to regenerate sweetgum or water tupelo

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Report Info:

- Forest Stewards Guild report http://www.forestguild.org/southeast or
- http://www.forestguild.org/publications (print-friendly version)
- Check out tables, Resources, References

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Final Thoughts on Bottomland Forests

- Keep on questioning, learning, exploring, and adapting
- Increase our collective knowledge of these systems
- Do your part to understand these systems and be able to relate them to the people we serve

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THANK YOU!

Amanda Mahaffey, Northeast Region Director, Forest Stewards Guild
amanda@forestguild.org, (207)432-3701
www.foreststewardsguild.org

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