



# Wildlife Forestry in Bottomland Hardwood Forests of the Atlantic Coastal Plain

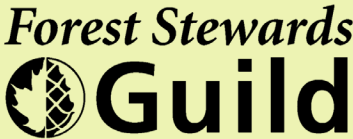
A SILVICULTURE GUIDEBOOK FOR FORESTERS





Marking trees for snag creation.

This wildlife forestry guidebook and corresponding management plan template were created to inform and guide foresters and land managers on wildlife forestry practices in bottomland hardwood forests of the Atlantic Coastal Plain. Wildlife forestry is managing forestland to improve habitat for specified wildlife, as well as overall forest health, while improving timber stand conditions, providing for forest regeneration, and producing forest products in an ever-changing environment (Locascio 2019). The focal area of this guide is bottomland hardwood forests of the Mid- and South-Atlantic Coastal Plain, but the concepts may be broadly applicable elsewhere in the region.



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# Silvicultural Management Decision Guide

## Why Wildlife Forestry?

Bottomland hardwood forests of the Atlantic Coastal Plain have been severely fragmented and only small sections of the original millions of acres exist today. Due to this, it is important to understand the function, condition, and needs of these forests on the landscape-level, particularly when managing for wildlife. Some wildlife species require large areas of intact forest for nesting, feeding, and travel corridors. Large tracts of bottomland hardwood forest often provide adequate wildlife habitat without human interference and do not require intensive management. Small tracts, often within a fragmented landscape, can benefit from restoration and enhancement activities.

Non-industrial landowners value their forests for many reasons. Common reasons include enjoying and protecting nature, generating income in the present, and providing a tangible asset for future generations. When landowners are asked about their forest management goals, most state that providing a place for wildlife and plants to live and thrive is more important than anything else (*i.e.*, timber, recreation, legacy, etc.). Accordingly, foresters and other practitioners can successfully connect with landowners by using wildlife as an objective for forest management.

Referencing wildlife is a crucial starting point in discussing forest management with landowners because the presence of certain species often indicates quality habitat. Bottomland hardwood forests are home to many different species of wildlife with diverse habitat needs, providing breeding and nesting habitat for interior songbirds, travel corridors for migratory wildlife,

and high-quality wetlands for aquatic species.

By looking at the forest through a wildlife habitat lens, both foresters and landowners can see the specific habitat features that forests provide. By targeting those features, silviculture can make working forests better places for wildlife.

## Steps to Implementing Wildlife Forestry Practices

Wildlife forestry aims to create forest conditions that will improve habitat for an increased suite of species, as well as overall forest health, while improving timber stand conditions, providing for forest regeneration, and producing forest products in an ever-changing environment. Creating wildlife-friendly forests starts with assessing forests and habitats at both the landscape and the stand level to determine appropriate management actions.

### Step One: Identifying Bottomland Hardwood Forests

There are many ways to describe bottomland hardwood forests of the Atlantic Coastal Plain. For example, the Society of American Foresters names 13 forest cover types in their forest cover type classification system, the U.S. Forest Service *Forest Inventory and Analysis* data defines only two, and the North Carolina Natural Heritage Program describes 18 different forested Coastal Plain Floodplain natural communities. In general, bottomland hardwood forests can be described as floodplain forests that occur on primarily alluvial soils containing plant communities that are well-adapted to wet or seasonally flooded conditions. These forests play a crucial ecological role by helping to control floods, improve water quality, provide carbon storage, and provide habitat for a variety of plant and animal species.

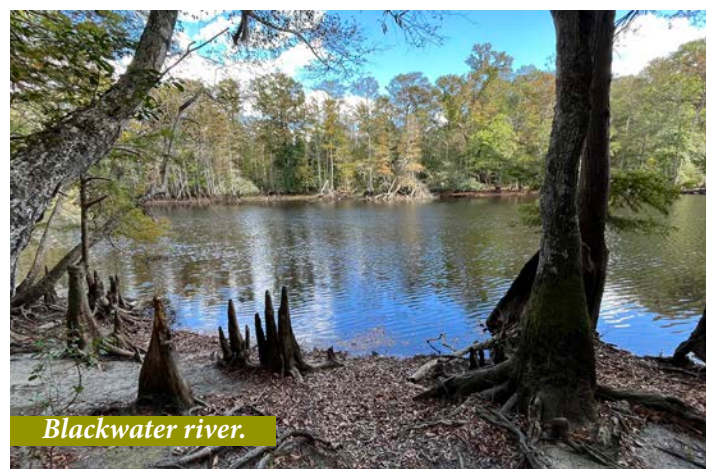
#### **Soils**

Soils in bottomland hardwood forests are dynamic, having formed from stream and river deposits of a variety of texture classes and nutrients. They are often hydric, meaning they formed under conditions of saturation (*i.e.* flooding).

Given their dynamic nature, soil models in alluvial systems can be misleading. Using soil data and maps such as the USGS Web Soil Survey can be helpful, however it is recommended to conduct site-specific soil tests for best results.

#### **Common Tree Species**

Common tree species found in bottomland hardwood forests and other forested coastal plain communities can vary widely depending on the hydrology and nutrient availability of the site. The wettest sites are often dominated by cypress and tupelo (*Nyssa spp.*). Drier sites are dominated by oak with sweetgum, hickory, or pine also occurring. River birch, American sycamore, sugarberry, box elder, Atlantic white cedar, green ash, and red maple can also be characteristic. Forests along brownwater rivers tend to be more diverse than forests along blackwater rivers.



**Blackwater river.**

Brownwater rivers begin in the mountains and Piedmont regions and primarily transport silt and clay. Sometimes these are also called redwater rivers. Blackwater rivers are generally short, slow-moving rivers that emerge from pocosins and swamps in the coastal plain and are more acidic.

*Acer negundo* | Boxelder

Bark is composed of brown, rounded, interlocking ridges. Twigs are opposite branched and bright green when young. Leaves are pinnately compound with 3-5 coarsely serrated leaflets.



*Acer rubrum* | Red Maple

Bark on young trees is smooth and gray, becoming dark and scaly as the tree matures. Twigs are opposite branched and bright red to dark brownish red. Leaves are simple with three to five lobes and coarsely toothed margins.



*Betula nigra* | River Birch

Bark on young trees is reddish brown and papery, peeling, and shaggy. Bark on older trunks is scaly and plated. Twigs are alternate branched, usually hairy and covered with resin dots. Leaves are ovate and doubly toothed, pointed at the apex and broadly wedge-shaped at the base.



*Celtis laevigata* | Sugarberry

Bark is light gray and can be warty/corky. Twigs are alternate branched and mostly glabrous. Leaves are ovate, rough-textured, and untoothed. Produces red fruits in the fall.



*Chamaecyparis thyoides* | Atlantic White Cedar

Bark is light-reddish brown and fibrous, easily peeling off in strips. Leaves are evergreen, scale-like, and tiny. Produces cones in the fall on stem ends that emerge purple and mature to brown.



*Fraxinus pennsylvanica* | Green Ash

Bark is grayish brown with narrow ridges and diamond shaped furrows. Twigs are opposite branched and greenish gray to gray with conspicuous white lenticels. The leaves are 6-12 inches long and pinnately compound with 5-9 untoothed leaflets.



*Liriodendron tulipifera* | Tulip Tree

Bark is gray to gray-green, nearly smooth on young trees and furrowed on old trunks. Developing furrows appear white. Twigs are alternate branched with a chambered pith, and when cut or broken yield a sweet and spicy fragrance. Leaves are simple with untoothed margins, palmately veined, mostly 4-lobed, with a distinct squarish shape.



*Nyssa aquatica* | Water Tupelo

Bark is dark brown or dark gray, thin, and scaly with fine fissures. Trees have a distinct flared base in flooded areas. Leaves are large, glossy, and margins are usually smooth except for a few large teeth. New leaves are usually finely downy.



*Nyssa biflora* | Swamp Tupelo

Bark is gray-brown and ridged. Leaves are alternate, simple, and untoothed. Produces a purple drupe in the fall. Often found growing in inundated soils.





*Pinus serotina* | Pond Pine

Bark is dark brown and broken into irregular, flattened, somewhat scaly plates. Young twigs are orange and glaucous and darken as they age. Needles are 6-8 inches long and in bundles of 3, sometimes 4.



*Pinus taeda* | Loblolly Pine

Bark is red to gray-brown with broad plates. Needles are 6-10 inches long and in bundles of 3. Cones are 3-6 inches long with sharp spined scales, and are produced in the fall and stay on the tree for a year before dropping.



*Planera aquatica* | Water Elm

Bark is scaly, gray-brown, with a shreddy appearance that can be easily torn from the trunk. Twigs are reddish to gray-brown and grow in zigzags. Leaves are simple and ovate with serrated margins, and often an asymmetrical base. Has distinctive bur-like fruit.



*Platanus occidentalis* | American Sycamore

Bark is mottled, reddish brown to gray, and scaly at the base of the trunk. Upper bark is light gray, and when scales flake off inner bark is white to light green. Twigs are orange-brown and grow in zigzags. Growth form is distinctly conical. Leaves are large, 3-5 lobed, with wavy scattered teeth.



*Quercus laurifolia* | Laurel Oak

Bark is dark brown with shallow fissures and flat, rough ridges. Twigs are alternate, light reddish-brown, and smooth. Leaf shape is variable, margins are untoothed and can have shallow lobes. Trees often retain their leaves into winter.



*Quercus lyrata* | Overcup Oak

Bark is light gray with large scales and deep furrows. Twigs are silver-gray, and young twigs can be hairy. Leaves can be 5-9 inches long and are widest in the middle. Leaf margins are entire with irregular deeply divided lobes.



*Quercus michauxii* | Swamp Chestnut Oak

Bark is light gray with deep furrows. Young twigs are green and turn brown after their first winter and progress to gray. Leaves are similar to chestnut oak with wavy rounded teeth but have hairy undersides.



*Quercus nigra* | Water Oak

Bark is brown and smooth when young and matures to gray-black with rough furrows. Twigs are slender, thin, and reddish brown. Leaves are highly variable, with as many as 11 distinct shapes on a single tree.



*Quercus pagoda* | Cherrybark Oak

Bark is initially smooth but develops small, rough, scaly ridges, resembling a cherry tree. Twigs are usually hairy when young and smooth as trees mature. Leaves are 5-8 inches long and 3-5 inches wide with 5-11 bristle-tipped lobes and shallow sinuses. The upper leaf surface is dark green and glabrous, while the lower leaf surface is greyish-white and densely covered with fine star-shaped hairs.



*Quercus virginiana* | Southern Live Oak

Bark is dark brown and slightly furrowed. Growth form is distinctive, with a broad crown and gnarled branches. Leaves are evergreen and leathery with downy undersides and untoothed margins.



*Salix caroliniana* | Coastal Plain Willow

Bark is furrowed and gray. Leaves are simple, long and narrow, with serrated margins, and typically about 8 inches long. Produces numerous showy yellow catkins in the spring.



*Salix nigra* | Black Willow

Bark ranges from light brown to black and develops deep grooves and a rough texture with shaggy scales as it ages. Twigs are easily broken off as the line between new and old growth is brittle. Leaves are narrow, finely toothed, 3-6 inches long, and lance-like with a long taper.



*Taxodium ascendens* | Pond Cypress

Bark is red-brown to silver-brown with many thin, vertical ridges. In comparison to bald cypress, pond cypress is somewhat smaller, has appressed, spirally arranged leaves, the root knees are more rounded, and it usually grows on pond margins as opposed to in the water.



*Taxodium distichum* | Bald Cypress

Bark is fibrous with thin, vertical exfoliating strips. Stems are alternate. Leaves are needle-like and feathery, with two flat needles on each branchlet.



## **Key to Coastal Plain Floodplain Forests**

Adapted from the North Carolina Natural Heritage Program Fourth Approximation.

1. Community forested, dominated by trees with closed to somewhat open canopy.
  - a. Forest very wet, dominated by combinations of tupelo species and cypress species with red maple, swamp poplar/cottonwood, and possibly ash generally the only other canopy species present.
    - i. Canopy containing water tupelo, which may be dominant, codominant, or present in substantial numbers.
      1. Water tupelo dominant, or codominant with bald cypress; swamp tupelo absent or scarce; occurring on brownwater rivers such as the Roanoke, Tar, Fishing Creek, Neuse, and Cape Fear...**Cypress—Gum Swamp (Brownwater Subtype)**
      2. Water tupelo and swamp tupelo codominant, with or without bald cypress; occurring on Coastal Plain rivers or streams with clay input from clay-rich watersheds or with calcareous influence...**Cypress—Gum Swamp (Intermediate Subtype)**
    - ii. Canopy lacking water tupelo or nearly so; occurring on blackwater rivers or smaller blackwater creeks with little to no clay input. Forest in sloughs or backswamps, including abandoned channel segments; flooded for long periods but exposed at normal low water; canopy generally dense if not recently disturbed; trees with large trunks if old; buttonbush and water elm absent or minor...**Cypress-Gum Swamp (Blackwater Subtype)**
  - b. Canopy with tree genera other than cypress and tupelo dominant or at least abundant, though cypress or tupelo may codominate.
    - i. Forest on a natural levee or point bar along the current (or recent past) channel of a brownwater river such as the Roanoke, Tar, Fishing Creek, Neuse, and Cape Fear; forest a mix of trees that includes American sycamore, river birch, green ash, sugarberry, or boxelder, as well as more wide-spread species.
      1. Forest on a young point bar deposit, only newly dominated by trees; canopy generally dominated by American sycamore, river birch, black willow, or coastal plain willow, with few other species; canopy often somewhat open; species shared with Sand and Mud Bar communities, such as panic grass often present...**Brownwater Levee Forest (Bar Subtype)**
      2. Forest on a natural levee.
        - a. Forest on a high natural levee and the inner Coastal Plain; canopy a diverse mix of species, including the above but also including sugarberry, green ash, boxelder, and others; community containing species such as dwarf buckeye, spicebush, wood-nettle, baby blue eyes (*Nemophila aphylla*) and *Corydalis flavula* that are shared with Piedmont levees...**Brownwater Levee Forest (High Levee Subtype)**
        - b. Forest on a natural levee of medium or lower height above the river; canopy may be a diverse mix of species but somewhat less so; the above suite of shrubs and herbs shared with Piedmont levees generally not present.
          - i. Forest on a natural levee or point bar of medium height above the river, in the inner to middle Coastal Plain, sometimes on the back slope of a higher natural levee; canopy generally a diverse mix of species but usually dominated by green ash, American elm, and American sweetgum; cypress and tupelo species minor or absent...**Brownwater Levee Forest (Medium Levee Subtype)**
          - ii. Forest on a low natural levee along downstream parts of the river or on the back slope of a higher natural levee; canopy limited to more water-tolerant species such as green ash, laurel oak, overcup oak, bitter pecan, and bald cypress...**Brownwater Levee Forest (Low Levee Subtype)**
      - ii. Forest not on a natural levee on a brownwater river; located away from the river or located along the channel of a blackwater river or a smaller stream.
        1. Forest in a small floodplain, with depositional landforms (ridges and sloughs) absent or too small to differentiate different communities (generally little more than 10 meters wide); canopy a mix of species of different moisture tolerance, often including tulip tree, sweetgum, oaks, tupelo, or cypress in vary-

ing combinations.

- a. Forest dominated by a mix of species that are tolerant of extremely acidic, saturated conditions, including tulip tree, swamp tupelo, red maple, pond pine, loblolly pine, and Atlantic white cedar but almost never includes oaks or sweetgum; forest generally with a dense shrub layer with species such as fetterbush, swamp cyrilla, and large gallberry that are shared with Streamhead Pocosins; community in the Sandhills Region or rarely in similar terrain elsewhere in the Coastal Plain...**Sandhill Streamhead Swamp**
  - b. Forest dominated by a mix of species less confined to extremely acidic, saturated conditions, that may include tulip tree, sweetgum, red maple, several species of oaks, loblolly pine, swamp tupelo, cypress, and occasionally species of mesic uplands but does not include pond pine or Atlantic white cedar; shrub layer open or dense but including species in addition to the above, such as fetterbush, spicebush, southern wax myrtle, or swamp dogwood...**Coastal Plain Small Stream Swamp**
2. Forest in a large floodplain of a blackwater or brownwater river, limited to a particular set of large depositional landforms such as ridges, flats, or terraces of a particular elevation and occurring in a mosaic with other floodplain communities; canopy generally dominated by a set of species with a narrower range of moisture tolerances, generally predominantly oak species.
    - a. Forest on a brownwater river floodplain; cherrybark oak, green ash, or water tupelo may be present depending on moisture levels; associated wetter community is Cypress—Gum Swamp (Brownwater Subtype).
      - i. Forest dominated by combinations of swamp chestnut oak, cherrybark oak, laurel oak, American sweetgum, and loblolly pine; occurring on the highest ridges and terraces (short of upland communities)...**Brownwater Bottomland Hardwoods (High Subtype)**
      - ii. Forest dominated by laurel oak, overcup oak, American sweetgum, and other species more tolerant of prolonged flooding, but lacking swamp chestnut oak, cherrybark oak, and loblolly pine.
        1. Forest dominated by laurel oak, overcup oak, American sweetgum but without tupelo or cypress...**Brownwater Bottomland Hardwoods (Low Subtype)**
        2. Forest dominated by a mix of species that includes significant tupelo or cypress, sometimes also green ash or pumpkin ash; herb layer often sparse and consisting of the most water-tolerant species similar to those in Cypress—Gum Swamp; occurring at elevations only slightly higher than Cypress—Gum Swamp...**Brownwater Bottomland Hardwoods (Swamp Transition Subtype)**
    - b. Forest on a blackwater river floodplain; cherrybark oak, green ash, and water tupelo generally completely absent; swamp chestnut oak may be present but is less likely to be.
      - i. Forest on a young point bar deposit, only newly dominated by trees; canopy generally dominated by river birch, water elm, black willow, or coastal plain willow, with few other species; canopy often somewhat open; species shared with Sand and Mud Bar communities, such as panic grass, often present...**Blackwater Levee/Bar Forest**
      - ii. Forest not on a young point bar deposit; on floodplain ridges, flats, or shallow sloughs, sometimes on the edge of the channel.
        1. Forest dominated by combinations of laurel oak with loblolly pine, American sweetgum, water oak, and occasionally swamp chestnut oak; overcup oak and bitter pecan generally absent...**Blackwater Bottomland Hardwoods (High Subtype)**
        2. Forest dominated by laurel oak in combinations with overcup oak and sometimes bitter pecan or American sweetgum, or more water-tolerant species; loblolly pine and swamp chestnut oak absent...**Blackwater Bottomland Hardwoods (Low Subtype)**

## Step Two: Assessing Wildlife Habitat Needs

There are several key features needed within a forest stand to create desirable conditions for wildlife. Promoting species and structural diversity within stands is the underlying principle of management. To assess the value of your forest stands for wildlife, complete the printer-friendly assessment on the following two pages. Once the assessment has been completed, use that information to help determine which management actions to take. Certain terms in the assessment are defined as follows:



Large snag.

**Overstory - Canopy Gaps:** Gaps in the forest with no trees to create space for sunlight to reach early successional species such as grasses and shrubs.

**Overstory - Closed Canopy:** Forests often have closed canopies, meaning the tree canopy does not allow sunlight to reach the forest floor.

**Midstory:** The layer of mid-sized trees between the overstory and understory that often provides important elements such as structure, snags, and soft mast-producing tree species.

**Understory:** The layer of saplings, shrubs, and herbaceous plants that can grow with varying levels of light that are necessary for some wildlife species for nesting, forage, and cover.

**Forest Health:** A healthy forest is characterized by biodiversity, sustainable productivity, and resilience to disturbances, supporting diverse plant and animal life while efficiently cycling nutrients and maintaining water quality. Non-native invasive species, hydrologic alterations, loss of old growth characteristics, and site inappropriate logging practices can threaten forest health.

**Water:** Vegetation communities along the margins of water bodies such as vernal pools, streams, rivers, and lakes often include plants that prevent erosion and provide food and cover for wildlife.

**Structural Features:** Variability in forest structure includes differences in size of live tree and other vegetation, foliage distribution, and variation in canopy density horizontally and vertically.

**Snags, Cavities, and Decay Trees:** Standing dead or dying trees provide a place to forage, nest, roost, and den.

**Coarse Woody Material:** Fallen trees and limbs add structure to the forest floor, providing shelter and foraging substrate.

**Fine Woody Material and Leaf Litter:** Undecomposed organic matter such as small branches, twigs, leaves, and needles on the forest floor provides nesting material and foraging substrate.



### Bottomland Hardwood Forest Habitat Assessment Form

These data can supplement a traditional forest inventory or be a standalone assessment tool. Assessments may be completed alongside each timber cruising point or as a summary of stand conditions. Data collected through VRP forest inventory.

<b>Landowner Name</b>		<b>Date</b>	
<b>Stand ID</b>		<b>Plot ID</b>	
<b>GPS Location</b>		<b>Elevation</b>	
<b>Forest Type</b>		<b>Age (circle one)</b>	<b>Young   Intermediate   Mature</b>
<b>Canopy/Vegetation Layers</b>			
<b>Overstory</b>	<b>Dominant Species</b>		<b>Stem Count</b> <b>Basal Area (10 BAF)</b> <b>Notes on size classes:</b>
	<b>Canopy Height</b> ___ < 30'   ___ 30-60'   ___ 60-90'   ___ > 90'		
<b>Midstory</b>	<b>Dominant Species</b>		<b>Percent Cover*</b> ___ High (>70%) ___ Medium (30-70%) ___ Low (5-30%) ___ Very Low (<5%)
<b>Understory</b>	<b>Dominant Species</b>		<b>Percent Cover*</b> ___ High (>70%) ___ Medium (30-70%) ___ Low (5-30%) ___ Very Low (<5%)
<b>Canopy Gaps</b>	How many per unit?	<b>Average Size</b> ___ <0.25 acres                      ___ 1-2 acres ___ 0.25-0.5 acres                    ___ >2 acres ___ 0.5-1 acre	
<b>Snags/Cavity/Decay Trees</b>			
Estimate the number of snags/cavity/decay trees within VRP			
<b>Small (&lt;9" DBH)</b>	<b>Medium (9-12" DBH)</b>	<b>Large (12-18" DBH)</b>	<b>Very Large (&gt;18" DBH)</b>
#	#	#	#
<b>Dead Woody Material</b>			
<b>Coarse Woody Material</b> Estimate the number of logs/ branches on forest floor >6" diameter and >4' length	___ High (>20 pieces, difficult to walk in places) ___ Medium (6-20 pieces, occasionally need to step over pieces) ___ Low (<6 pieces, easy to walk through, park-like)		

<b>Fine Woody Material</b>		___ High (>5 piles)
Estimate the amount of twigs, small branches and tops/slash		___ Medium (1-4 piles)
		___ Low (No piles)
<b>Leaf Litter</b>		___ >1.5" thick
Estimate average leaf litter thickness		___ <1.5" thick
		___ Not Applicable
<b>Forest Health</b>		
<b>Invasive Plants</b>	<b>Species Present</b>	<b>Percent Cover</b>
<b>Herbivory, Invasive Insects, and/or Disease</b>	<b>Describe</b>	
<b>Water</b>	<b>Describe</b>	
<i>E.g., distance from flowing water, wetland habitat present, etc.</i>		
<b>Notes</b>		

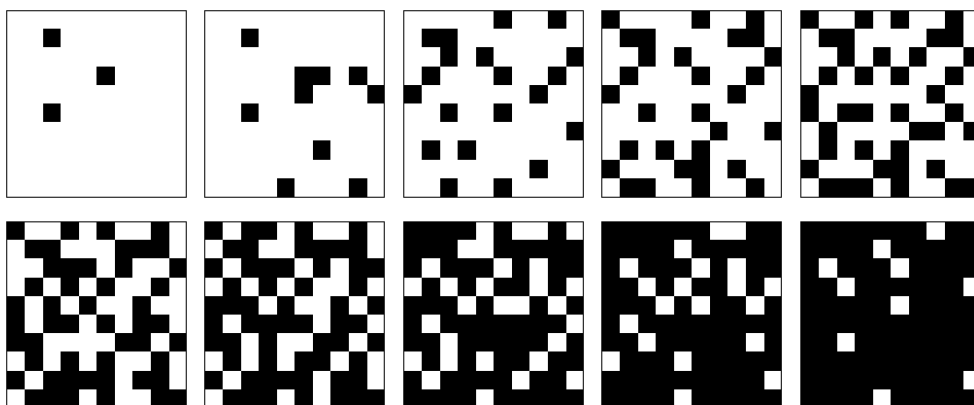
**\*Guide to Estimating Percent Cover**

**Very Low (<5%):** Virtually no cover present

**Low (5-30%):** Little cover throughout or in small patches

**Medium (30-70%):** Moderate cover throughout or scattered patches of dense cover

**High (70-100%):** Dense cover throughout the area



*The shaded boxes represent the visualization of percent cover from 5% in the upper left to 90% in the lower right*

### Step Three: Selecting Appropriate Management Practices

Bottomland hardwood forests of the Atlantic Coastal Plain were shaped by natural disturbances such as hurricanes, tornadoes, fires, and frequent flooding. In recent years, human-caused alterations have shifted these disturbance regimes primarily through hydrologic modifications (e.g. constructing dams, levees, and ditches). Properly implemented silvicultural practices that mimic natural disturbance events can help to restore these forests and the important habitat they provide.

While the habitat needs of wildlife found in bottomland hardwood forests vary, there are universal management practices to maintain wildlife-friendly features such as habitat connectivity and structural diversity that will benefit overall species diversity and abundance.



#### **A Note on Constraints**

**Operational:** Bottomland hardwood forests are hydrologically complex, and management requires unique operational considerations and specialized equipment and methods. As a general practice, adhere to your state's Best Management Practices (BMPs) for water quality as they relate to operations in wetland forests. While timber harvesting and other ongoing silviculture activities are exempt from having to obtain a federal water quality permit under Section 404 of the Clean Water Act, implementing BMPs is important to maintain this exemption.

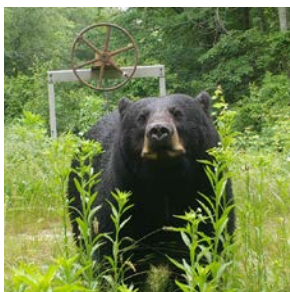
**Financial:** Implementing wildlife forestry practices in bottomland hardwood forests may not be financially feasible for every landowner, as timber revenue is likely less with each entry compared to conventional practices. Market conditions are constantly in flux and forest product market access heavily influences what can and cannot happen operationally in the woods. Utilizing cost share programs can help offset some of the costs incurred.

#### **Universal Management Practices for Wildlife**

- Prioritize sites in proximation to existing target species populations. This is crucial for inhabitation by the species.
- Always seek to address invasive species management prior to silvicultural treatment or in conjunction with the management activity.
- Retain trees containing small and large cavities and limit damage to cavity trees during harvest.
- Manage for a mosaic of forest types across the landscape. Many species need young forest as well as mature forests and sometimes, 'doing nothing' and letting the forest grow is an active management decision.
- Keep contiguous buffers along perennial streams and limit management in riparian zones.
- Limit management activities during bird breeding seasons when possible.
- Soften edges between habitats. An example of an abrupt edge is the border between a forest and a farm, and this can cause negative edge effects. Negative edge effects are the consequences of abrupt changes in conditions between differing vegetation communities. Negative edge effects include increased risk of predation, brood parasitism, invasive species invasion, and adverse microclimate conditions.
- Harvest during dry periods and use low ground pressure harvesting equipment to reduce soil damage and diminish hydrologic impacts.
- When constructing water crossings, use fords (low water crossings) or bridges to enable the passage of aquatic wildlife.
- Harvest smaller areas. Large harvests can inhibit evapotranspiration and create inundation and saturation on the site, inhibiting growth and regeneration of desired tree species.

## ***Habitat Enhancement Recommendations Based on Wildlife***

It is important to note that managing for all species within one stand is often not a realistic goal. The focal species in this guide are representatives of different habitats, and while managing for all across the landscape is desirable, managing for all within a single stand is seldom feasible.



### **Black Bear**

Black bears and other large mammals live in large, contiguous forested areas with multiple tree species and high structural diversity. To achieve these conditions, we recommend implementing a variable retention harvest or femelschlag that incorporates group and individual selections. Additionally, retain hard and soft mast species such as oaks, sugarberry, blueberries, and palmetto.



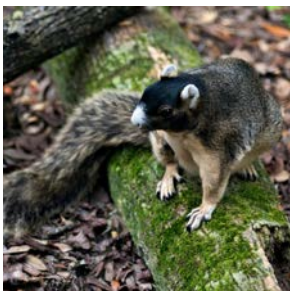
### **American Woodcock**

The American Woodcock and other game birds are associated with early successional habitats containing high densities of saplings, shrubs, and cane. To achieve these conditions, we recommend implementing a regeneration harvest such as seed tree, shelterwood, or group selection.



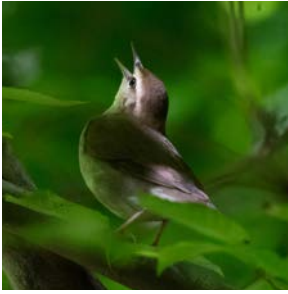
### **Marbled Salamander**

The marbled salamander and other amphibians are associated with wetlands and floodplain pools with abundant coarse woody debris and leaf litter. To achieve these conditions, retain coarse woody debris and maintain forested riparian buffers.



### **Fox Squirrel**

Fox squirrels are found in mature hardwood forests with sparse understories. In mature and older bottomland hardwood stands retain cavity trees, snags, and trees that provide a diversity of food resources throughout the year.



**Swainson's Warbler**

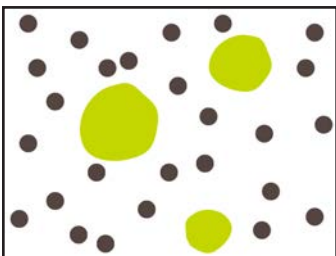
Swainson's Warblers are associated with mature bottomland hardwood forests with well-developed canopies, dense understories, and extensive leaf litter. To achieve these conditions, implement group selections particularly where growth of canebrakes and dwarf palmetto can be enhanced/encouraged.



**Tricolored Bat**

Tricolored bats and other forest bats nest in tree cavities and loose bark found in mature bottomland hardwood forests. To achieve these conditions, leave cavity trees and snags.

**Silviculture Strategies**

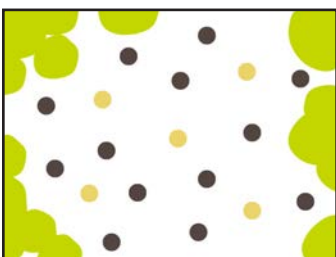


**Seed Tree**



**Femelschlag**

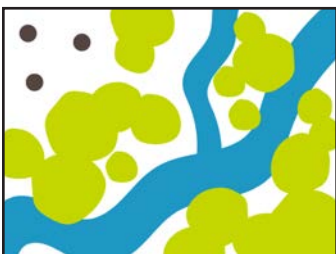
- Leave tree
- First entry cut
- Second entry cut



**Shelterwood**



**Single Tree Selection**



**Riparian Buffer**



**Group Selection**



*Harvested hardwood trees.*

### ***A Note on Marking Timber in Selection Silviculture***

Note that selection silviculture should not be confused with selective harvesting, which is often synonymous with “high-grading” or “diameter-limit cutting.” Selective harvesting, or high-grading, is an unsustainable forestry practice of removing the largest and highest value trees in stand, with little to no thought for appropriate regeneration for the long term.

To successfully implement single-tree or group selection silviculture treatments in bottomland hardwood systems, consider the following:

1. Assess the soil. Some fragile soils are impossible to log without causing significant damage to soil health. Is it worth damaging the soil to harvest only a handful of trees?
2. Identify what is regenerating naturally and where. The point of selection harvests is to set the stage for regeneration. For example, a small group selection could be formed around patches of advanced regeneration. When possible, natural regeneration should be the first option as planting is expensive and risky.
3. Visualize what your desired forest condition looks like and know going into marking what the stand will look like postharvest. What species do you want to retain? What is the desired residual basal area?
4. Identify the individual trees to be retained. First consider desired tree species, then judge whether it is capable of three-dimensional growth. If there are multiple trees competing for light determine if they can increase in grade, increase in merchantable height, or increase in diameter. For example, if one tree can only increase in diameter while its neighbor can put on a second log, then select the neighbor for retention. The goal is to promote trees with free-to-grow crowns that are most likely to increase in value (both habitat value and financial value).
5. Determine whether you will paint the leave trees or the trees to be harvested. Often in a single tree or group selection it is more feasible to mark the trees to be harvested. Use a different color of paint or flagging to signal the harvest boundary.
6. Communicate to contractors the reason for taking or leaving specific trees and stress the need to avoid damage to the residual stand when felling and skidding.
7. Be realistic. The contractor may fear a loss of production. This will likely require an increase in normal cut-and-haul rates to compensate for the lower per acre production rate.

## Step Four: Incorporate into Forest Management Plan

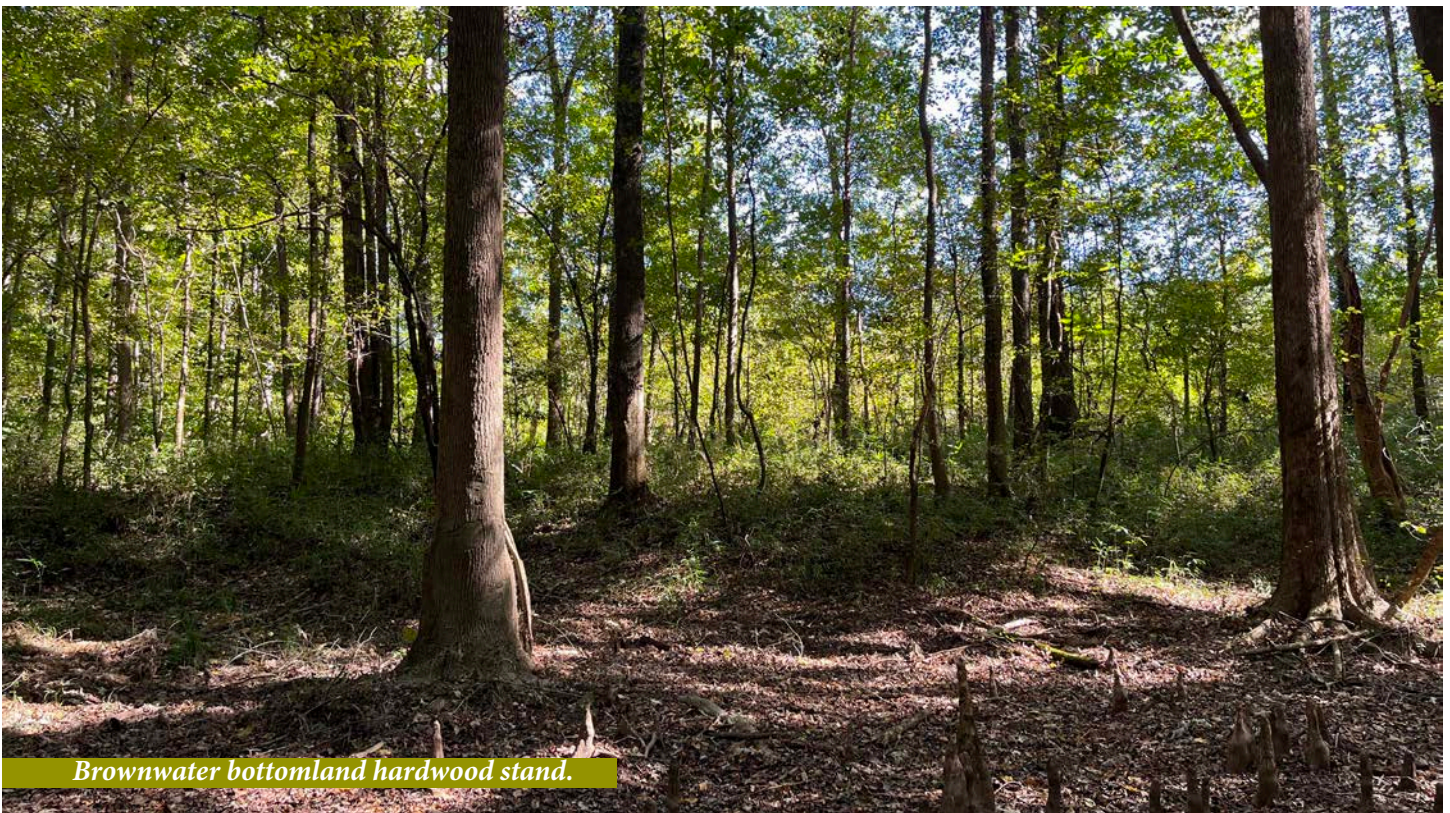
After the conditions of your forest have been evaluated and a management strategy has been determined, incorporate the suggestions into a Forest Management Plan. It is important to highlight the connections among forest structures, wildlife habitat, and active management. A forest managed to improve conditions for wildlife can also support healthy watersheds, sustainable timber harvests, and resilient communities for years to come.



*Marking trees for an understory removal.*



*Marbled salamander.*



*Brownwater bottomland hardwood stand.*

# Completing the Forest Management Plan Template

This section is meant to be used in reference to and read alongside the Forest Management Plan Template document that can be found online at [www.ForestStewardsGuild.org](http://www.ForestStewardsGuild.org). The Forest Management Plan Template was structured to comply with the NRCS Conservation Planning Activity (CPA 106) requirements.

The first three pages of the document are the **Title Page, Signatures and Approvals**, and **Table of Contents**. The Table of Contents will update automatically when refreshed.

Before the **Introduction** section, there is a space for **Conservation Assistance Notes**. Here, Conservation Assistance Notes must be date-ordered and include initials of note-maker, date, results of the interaction or activity completed, and those present. Document each client interaction and each field visit.

The **Introduction** section includes easy-to-follow prompts that are standard in forest management plans.

Also included in the Introduction is a section regarding the land use history of the property. Here, we include a special section dedicated to the **Historical Landscape Context** of the property and/or surrounding landscape. It is important to acknowledge the history of the landscape, including the [presence of Indigenous peoples](#) and their traditional uses and connections with the land. As original stewards and inhabitants, they shaped the forest's unique mix of tree and other plant species, soils and waterways, and habitat for wildlife. Other relevant management history of the parcel will go in **Management History**.

The **Property Maps** section should include a location map, forest management plan map(s), and soil map(s). All maps must include map title, client name, Technical Service Provider name, conservation district, county, state, date prepared, scale, location identifier, north arrow, appropriate map symbols, and

## Historical Landscape Context Example

The Smith property is located in the Chowan River Basin, the historic homeland of the Chowanoke Indians. The Chowanoke are a Southern Algonkian Indian tribe. Before European settlement, the Chowanoke lived for centuries on the riverbanks of the Chowan River. They fished, farmed, and foraged much of what can still be found today. Plants such as palmetto, yucca, river cane, and tulip tree were foraged and cultivated for numerous uses such as food, medicine, construction materials, and musical instruments. Their practices and management helped shape the Southeastern landscape.

a legend. Specifically, the forest management plan map(s) should have:

- Boundary lines for the Planning Land Units (PLUs) with labels (name, number, or both). A PLU is a unique geographic area, defined by a polygon, which has common land use and is owned, operated, or managed by the same participant or participants. The PLU is the minimum unit for planning.
- Land-use designation and any applicable land-use modifiers such as irrigation for each PLU, as appropriate. The NRCS-recognized land use names and land use modifiers are listed in the [National Planning Procedures Handbook](#), Definitions



section. (Handbook 180, Part 600.2)

- Acreage for each PLU.
- Location of sensitive resources and setbacks, if applicable.
- Locations of planned and applied management activities.
- If the planning area includes nonprivate lands, such as Federal or Tribal lands, a land status map must be included to display land ownership categories (Private, State Trust, BLM, Tribal, Territorial, etc.).

An important part of the **Property Overview** section is the **Fish, Wildlife, and Biodiversity** section as this contains some of the primary information needed to practice wildlife forestry.

Within the section, list the desired wildlife improvement activities taken from the Silviculture Management Decision Guide. These activities could include general practices such as snag creation, feathering of edges, and other practices deemed appropriate for the site.

Lists of rare, threatened, and endangered species and Species of Greatest Conservation Need (SGCN) by county and watershed can be found using your state's Natural Heritage Program or Department of Natural Resources datasets. Find rare, threatened, and endangered species and SGCN for the county and/or watershed of your management area and copy/paste the table into this section. It is possible to obtain these lists through [NatureServe Explorer](#).

A list of commonly used Ecological Systems and/or Forest Types can be found in NatureServe's [Descriptions of Ecological Systems for Modeling of LANDFIRE Biophysical Settings](#) and corresponding GIS data can be found on their [Products](#) page.

In the **Management of Forest Resources** section, a checklist is included for habitat management recommendations. In the **Forest Health Concerns** section, complete the table to list the detrimental native species impacts (e.g. deer over-browsing), invasive exotic pests, pathogens, and plants that currently threaten forest health or are likely to do so in the near future.

Foresters and landowners should plan for the short- and long-term effects from regional invasives. Always seek to address invasive species management prior to a silvicultural treatment or in conjunction with the management activity. See Table 2 and Table 4 for example.

Use the **Monitoring of Forest Resources** section to describe the basic plan for the landowner to monitor forest growth and dynamics, wildlife habitat and use, and impacts of management activities. Monitoring may be optional and depending on the size and scale of forest management, effective monitoring can take a variety of forms. For example, a landowner could go on a forest walk twice per year and take notes about observations of invasive species present and the conditions of roads. Other actions could include listening for specific birds during breeding season, re-inventorying the forest every 10-15 years, or working with a university to conduct empirical research.

The verification of **Professional Assistance** is necessary in certain instances when applying for cost-share funding or other circumstances.

In most forest management plans, **Stand-Level Information** is the most important content. This section includes easy-to-follow prompts that are standard in forest management plans. To add additional stand description pages, click on the page and then click the blue + on the lower right-hand corner to add more pages.

The **Forest Management Activities** schedule in this plan template includes space to include cost-share program information as desired. NRCS has state-level programs that are sometimes applicable to bird-friendly forest management practices. NRCS program schedules, project activities and corresponding codes, and rates can be found [online at NRCS's Conservation by State webpage](#). See Tables 3 and 4 for examples.

This is the final section of the Wildlife Forestry Management Plan Template. Appendices can be added as needed. Useful appendices might include: additional soils information from Web Soil Survey, stand inventory data, information about focal wildlife species, and/or additional maps.

Table 2. Example of Forest Health Concerns entry using Japanese stiltgrass.

Threat	Scope (% Covered)	Severity (1-10 scale)	Potential Impacts	Mitigation Strategy
Japanese stiltgrass	14% of stand	6	Complete understory takeover	Apply herbicide and mow to stop seed production


Table 3. Example of activity applicable to an NRCS cost share program.

NRCS Tract Number	Stand(s)	Activity/Consvration Practice	Code	Units	Planned Month/Year	Effects of No Action
T1234	1	Forest Stand Improvement	666	25 ac	2024	Lack of growing space for crop trees

Table 4. Example of activity not applicable to an NRCS cost share program.

NRCS Tract Number	Stand(s)	Activity/Consvration Practice	Code	Units	Planned Month/Year	Effects of No Action
NA	2, 3, 4	Cut stump herbicide	NA	10 ac	2023-2026 annually	Native species displacement by invasive tree of heaven





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