



Forestry for Maine Birds

A GUIDEBOOK FOR FORESTERS MANAGING
WOODLOTS “WITH BIRDS IN MIND”



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AUDUBON



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Forestry for Maine Birds

A FORESTER'S GUIDE

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I. Introduction to Forestry for Maine Birds

Forestry for Maine Birds offers a new approach to integrating bird conservation with forest management and planning.

Forestry for Maine Birds:

- **improves** habitat for priority forest birds and a variety of other wildlife species
- **engages** woodland owners in forest stewardship
- **works** with other forest management goals, and
- **enhances** the value and enjoyment of Maine woodlands for many generations to come.

WHY IS MAINE SO IMPORTANT TO BIRDS?

Every spring, the Maine woods come alive with color and song. Bright warblers return from points far south to sparkle like jewels in the trees. Sturdy woodpeckers and hardy chickadees that stay in Maine all winter look for nesting cavities in dead or rotting trees. Stealthy

thrushes hide in dense vegetation, though their resounding flute-like songs give their location away. **The Maine woods literally fill with more than 90 different species of birds, many here for just three short months to do one thing: make baby birds. Lots and lots of baby birds.**

Maine forests are, in fact, baby bird factories. They provide a variety of *habitats** or places where animals find what they need to survive, including food, water, cover, and a place to raise young. For birds, long days, abundant food, and a variety of places to build nests, hide from predators, and feed their young make the Maine woods an ideal place to raise baby birds.

WHAT IS THE PROBLEM?

Populations of many forest birds have been steadily declining in recent decades, as threats con-

*Most technical terms are in ***bold italics*** and are included in the glossary (Appendix A, p. 110).



tinue to grow. Habitat fragmentation, development, chemical contamination, and air pollution coupled with habitat loss at migratory stopovers, on wintering grounds and on summer breeding grounds, contribute to these declines. Climate change adds an element of uncertainty to the future as plant and animal species shift and move, ecological communities change, and more intense storms change forest dynamics.

HOW CAN FORESTRY FOR MAINE BIRDS HELP ME MANAGE WOODLANDS?

The Maine woods can play a critical role in reversing declines for forest birds. If we can enhance and conserve Maine's "baby bird factory," we can increase the likelihood of population recovery. Without steady production of baby birds, any habitat improvements in other parts of their range will be less effective. Breeding habitat in Maine is critical to the long-term success of forest birds.

That is where *Forestry for Maine Birds* (FFMB) comes in. A principle outcome of FFMB practices is the promotion of healthy forests with strong structural and age-class diversity that mimics natural disturbances and the structural features they create. FFMB does this by encouraging foresters, loggers, landowners, and land managers to consider the needs of forest birds when managing their forests. FFMB provides tools to assess existing habitat and to plan activities that ensure a mix of habitat conditions across the landscape over space and time.

FFMB is forestry "with birds in mind." Forest management and operations enhance, create, or conserve current and future bird habitat while meeting other property objectives. Landowners frequently list the improvement of wildlife resources as an important forest management goal. FFMB gives foresters and landowners the tools to reach that goal and create high-quality wildlife habitat.



While birds are the focus of FFMB, managing forests “with birds in mind” also serves the needs of many other wildlife species.

HOW IS THIS GUIDEBOOK ORGANIZED?

■ **Section I:** Introduction to *Forestry for Maine Birds*

■ **Section II:** *Maine’s Priority Forest Birds* reviews the habitat needs of 20 priority bird species of conservation concern in the Northeast. These FFMB species are relatively easy to identify by sight and sound, even for those with little or no birding experience.

■ **Section III:** *Maine’s Forest Bird Habitat* reviews the major forest types found in Maine and the forest habitat structures most important to FFMB priority species.

■ **Section IV:** *Forestry for Maine Birds Habitat Assessment* reviews the protocol for assessing stands for bird-friendly forest habitat structures and also addresses the context of a stand within a larger forested landscape.

■ **Section V:** *Managing Forests with Birds in Mind* provides recommendations for developing a management plan “with birds in mind” at the stand, property, and landscape levels and offers examples of how FFMB management might be incorporated into a forest management plan.

WHO DEVELOPED FORESTRY FOR MAINE BIRDS?

FFMB is a collaborative effort of Maine Audubon, the Forest Stewards Guild, the Maine Forest Service, and the Maine Department of Inland Fisheries and Wildlife. FFMB materials are adapted from Vermont’s “Foresters for the Birds” program, which was first developed in 2008 by Audubon Vermont and the Vermont Department of Forests, Parks, and Recreation. That program has been shared with hundreds of foresters and landowners.

FFMB also relies heavily on the concepts, forest type descriptions, and management recommendations in ***Focus Species Forestry***, a guidebook developed by Maine Audubon to help foresters and landowners manage forests to enhance habitat for a diverse array of representative wildlife species including amphibians, birds, and mammals. The ***Focus Species Forestry*** guidebook is available at the FFMB website at maineaudubon.org/FFMB.

WHO SHOULD USE THIS GUIDEBOOK?

While geared to foresters, anyone with an interest in forest management and bird habitat should be able to read through this guidebook and get a good idea of the key elements needed to manage forests “with birds in mind.”

HOW DO I LEARN MORE?

The *Forestry for Maine Birds* website (maineaudubon.org/FFMB) has numerous resources to support forest management and planning “with birds in mind,” including summary species pages suitable for inclusion in forest management plans, editable versions of the FFMB datasheets, and upcoming FFMB events and workshops.

II. Maine's Priority Forest Birds

The northeastern forests are home to a more diverse mix of birds than most other regions of the U.S. (Fig. 1). More than 90 bird species breed in the Maine woods, and many others migrate through each spring and fall. Maine's abundant forests—over 17 million acres—are diverse and varied, providing everything birds need to survive and thrive throughout the breeding season. Even so, the number of species recorded on breeding bird survey routes in Maine and throughout the Northeast has dropped 10–20% in recent years compared to the earliest bird surveys in the late 1960s and 70s (USGS, pers. comm.).

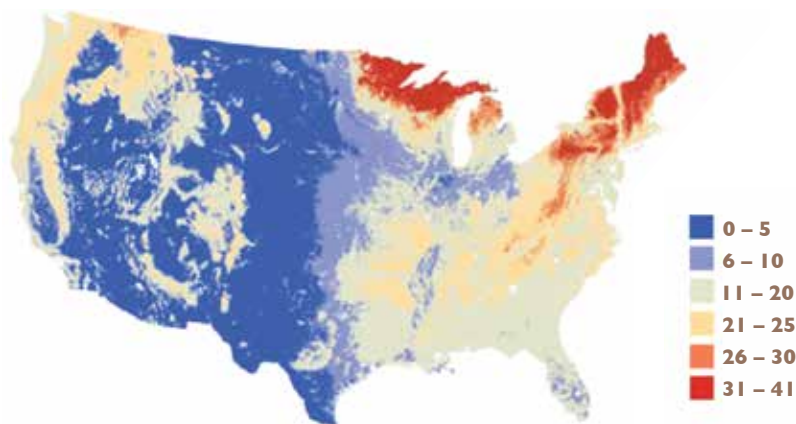
FOREST BIRDS NEED FOOD, COVER, PLACES TO NEST, AND ROOM TO BREED

Some birds are found almost exclusively in *softwoods*, others

only where there is a predominance of *hardwoods*, and still others are generalists that can use forests with a mix of both. Some species prefer older forests with diverse physical structure while others are more often found in younger forest patches. **Wherever they might occur, breeding forest birds are looking for food, cover, places to nest, and room to breed.**

Food Abundant insects and fruiting trees and shrubs produce a tremendous variety and volume of food for both migratory birds and for breeding birds and their growing chicks. **Gaps** in the forest provide openings in which insects thrive on ground cover and younger vegetation. Some bird species specialize in catching insects on the wing in these openings. Long days also give birds more time to eat and feed their growing young.

Figure 1. Species richness, or the average number of forest species per route, modeled from Breeding Bird Survey data (2004–2006). Reproduced with permission from Goetz et al. 2014.



Cover Forest birds need to hide themselves (and their nests and young) from hungry predators such as hawks, snakes, foxes, skunks, and red squirrels. Maine's diverse forests provide cover under leaves and in dense vegetation, piles of dead wood, and camouflaged leaf litter.

Places to Nest Forest birds are surprisingly specialized in their nesting habits. Some species nest close to tree trunks or on the lowest branches within a dense *understory* while others nest on the very tips of branches closer to the treetops. Some species like to nest under a closed *canopy*, which provides more shade and less light in the understory, while others prefer to nest under a more open canopy that allows more light to reach the forest floor. Some species such as woodpeckers excavate cavities in *snags* or trees with rotted branches. A few species nest in deep *leaf litter* on the forest floor. The physical structures found in Maine's different types of forests create a variety of nesting places for many different species.

Room to Breed All birds need a large enough *territory* to find the food, cover, and nesting sites they need to successfully raise their young. Males need places within their territory from which to sing to attract mates. Several of the FFMB priority birds need tall trees on which to perch and sing from the very top of the canopy. Others sing from branches in the *mid-story* or shrubs in the understory. Territory size will vary depending

HOW DO WE KNOW BIRDS ARE IN TROUBLE?

Two long-term studies provide much of what we know about the status of bird populations in North America.

Breeding Bird Survey (BBS): The BBS is an international program started in 1966 to track the status and trends of North American bird populations. Thousands of dedicated volunteers follow a rigorous protocol to count birds in early summer along randomly established roadside routes. You can view BBS data, including population trends, at www.pwrc.usgs.gov/bbs.

Christmas Bird Count (CBC): Coordinated by National Audubon since 1900, the CBC captures an early winter snapshot of bird populations across North America. CBC volunteers survey a 15-mile diameter circle over the course of one day in late December or early January. For more information and to view data summaries, visit audubon.org/conservation/science/christmas-bird-count.

Conservation organizations and agencies such as Partners in Flight, the Atlantic Coast Joint Venture, National Audubon, Maine Audubon, and the Maine Department of Inland Fisheries and Wildlife use BBS and CBC data to identify high priority species for many different bird conservation initiatives.

on the bird's size and how far it has to roam to find everything it needs. Territories tend to be smaller in higher quality habitat, often where there is more "mess" or structural complexity in the forest.

PRIORITY BIRDS FOR CONSERVATION

FFMB identifies 20 forest bird species of high conservation priority based on declining populations (see sidebar, p. 8), growing risks and threats, and/

TWO BIRDS, TWO TRENDS, SAME CONSERVATION PRIORITY



Canada Warblers are small forest songbirds that nest on or near the ground in hardwood and mixedwood forests with a dense, complex understory (for more details see page 26). Canada Warblers are one of the most at-risk forest songbirds due to declining populations and a long list of growing threats, including habitat loss and degradation (Figs. 2 and 3).



Yellow-bellied Sapsuckers are woodpeckers that need large (>9" DBH) decaying trees or snags in hardwood and mixedwood forests for excavating nesting cavities (for more details see page 23). Yellow-bellied Sapsucker are holding steady or even increasing in places (see green areas on map), but are considered a stewardship species because over 30% of their global population breeds in the Atlantic Northern Forest (northern New England, New York and the Maritime Provinces). Conservation efforts in this part of its range will contribute in a disproportionately positive way to long-term population stability (Figs. 4 and 5).

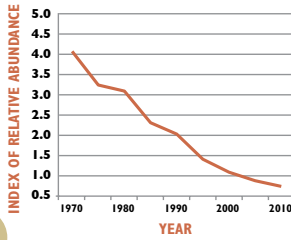


Fig. 2

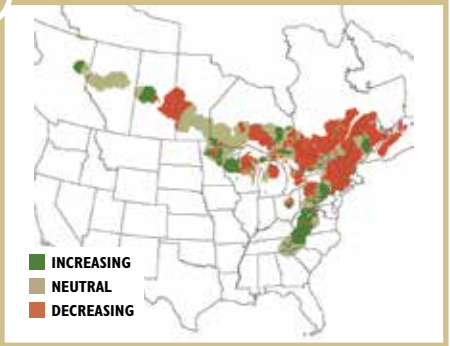


Fig. 3

Figures 2 & 4: Relative index of abundance from BBS surveys (1970–2010) in the Atlantic Northern Forest.

Figure 3 & 5: Percent change per year from BBS survey route data (1996–2014). Green indicates a positive change (+1.5% or greater increase each year), orange indicates a negative change (-1.5% or worse decrease each year), tan indicates no change (<1.5 and >1.5% change per year).

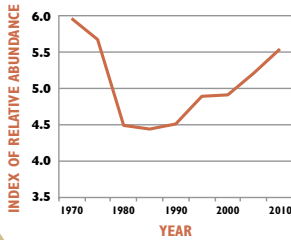


Fig. 4

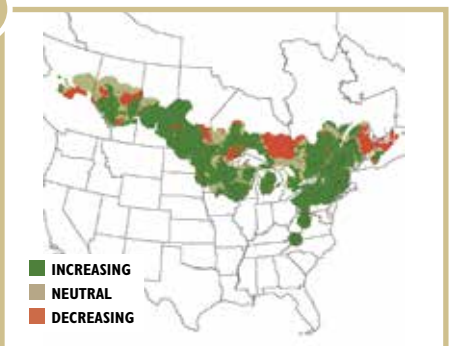


Fig. 5

or the relatively high proportion of their global populations found in the Northeast. While many additional forest bird species are at risk and in decline, the 20 species selected as FFMB priorities use a variety of different forest types and habitats for feeding and nesting, and most are relatively easy to find and identify. For a list of various regional and national prioritization schemes as well as the population trends used to rank species, see Appendix B, p. 113.

We have the opportunity to make a difference in the future of these species by improving their forest habitat right here in Maine. If forests across a landscape are managed to keep a mix of structures and features for these 20 species, they will also provide habitat for many other wildlife species that call the Maine woods home.

THREATS TO FFMB PRIORITY BIRDS

Habitat Conversion Forest bird breeding habitat is lost when forests are converted to other uses such as development or agriculture. Between 1991 and 2012, nearly 100,000 acres of Maine forestland were converted to nonforested uses, with over half of that loss in southern Maine (Barton et al. 2012). Because most of Maine's forest birds spend much of the year outside of the state, habitat conversion of forests on the wintering grounds is also a concern and has long been documented as a cause of decline for long-distance migrants. Loss and degradation of

migratory stopover habitat on the way back and forth between wintering and breeding grounds is also a threat to population stability. If migrating birds can not find places to rest and feed during migration, they may not make it back to breed next year.

Fragmentation Certain *forest-interior* birds prefer nesting in larger blocks of contiguous forest. When these larger forest blocks are fragmented into smaller blocks by roads, residential development, forest management, or agriculture, these species may no longer nest in the remaining smaller blocks. If they do continue to nest, they often have lower reproductive success. Some species are also *area-sensitive*, meaning the condition of the habitat beyond the boundaries of their territory, including forest fragmentation across the landscape, can affect their choice of nesting sites and reproductive success. Fragmentation can also create more forest *edge habitat*, which may lead to increased nest predation or nest parasitism. In forests near agricultural lands, Brown-headed Cowbirds lay their eggs in other species' nests. The host parents then raise the bigger, more aggressive cowbird chicks, which often push out the host offspring.

Acid Rain and Mercury Rainfall that mixes with elements and gases, particularly sulfur dioxide and nitrous oxide from fossil fuel combustion, becomes more acidic. Although this acid rain typically originates in urban areas, it can be

carried hundreds of miles through the atmosphere to forests and lakes far from its source. Acid rain causes the release of substances such as aluminum that can be toxic to trees and harm calcium-rich invertebrates such as snails and millipedes that are important food sources for many birds.

Mercury is a heavy metal pollutant and neurotoxin that is also carried through the atmosphere from many sources, including far-away sources such as Midwestern power plants. Mercury rains down on Maine's forests, and though the pathway is still unclear, it ends up in sometimes high levels in forest birds. While birds with the highest mercury levels typically live near wetland ecosystems, many upland species such as Wood Thrush and Bicknell's Thrush have been documented with high levels of mercury (Osborne et al., 2011). Direct effects of high mercury loads, while not studied in forest songbirds, have been shown to alter behavior and reproductive success in other bird species.

Climate Change The effects of the changing climate will no doubt play a role in the future security of Maine's forest birds. Several species, including Red-bellied Woodpecker, Carolina Wren, and wintering Eastern Bluebird, have been moving north into Maine in recent decades. Other species such as our state bird, the Black-capped Chickadee, are predicted to become uncommon in all but the very northern and western reaches of the state by 2100.

National Audubon models predict drastic range changes for 50 Maine species as habitats change and the timing and abundance of available foods shift (climate.audubon.org).

Foresters can help prepare for these changes and minimize the most severe impacts by retaining or enhancing native tree species diversity, encouraging trees adapted to warmer climates, and maintaining a range of age classes and structural complexity within the forest (Whitman et al., 2014). Forests are also one of the most important sinks of global carbon; the older the stand, the more carbon it holds. Managing stands to reach mature and late-successional stages will help keep carbon out of the atmosphere.

Balance of Age Classes It is the nature of forests to grow and change over time, but the nature of Maine's forests has changed much more dramatically in recent years due to human activities. Timber harvesting, agriculture, and development have altered the balance of forest age classes, resulting in very different types of bird habitat across the landscape. More recently, the loss of older forest across much of northern Maine has had serious implications for many FFMB species. In contrast, the limited amount of young forest across parts of southern Maine has also raised concerns that this type of forest habitat is lacking (see sidebars, pp. 12–13).

In light of all these threats and challenges, the answer for forest management, from a bird's perspective, is the same: Managing over space and time to create patches of young forest interspersed within large blocks of structurally complex, or “messy” older forest (or forests with the structural characteristics of an older forest) will help create diverse habitat for the 20 FFMB priority species and a host of other wildlife species that use similar habitats and forest features.

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MAINE'S DIVERSE FORESTS

THEN AND NOW

Maine's forest birds evolved in and adapted to a forest that looks very different from what is on the landscape today. Older, larger trees dominated Maine's pre-settlement forest. Models estimate trees over 150 years old made up 70 to 89% of northern hardwood forest stands and 72 to 79% of spruce-northern hardwood stands (Fig. 6a, Lorimer and White, 2003). These trees were much larger than trees typically found on today's landscape.

Disturbance regimes varied by forest type and location. Wind and ice storms created swaths of blowdown, though rotation cycles for large events were likely greater than every 1,000 years. These events were probably larger and more frequent in

forests near the coast where hurricanes were more common. Individual trees toppling from old age or from insect or disease damage probably created more frequent smaller gaps of regenerating trees.

Maine lost about five million acres of its forest by the late 1800's due to clearing for agriculture (Irland 1998), though most of this acreage has returned as forest today. Recent estimates put Maine's forested acreage at more than 17.2 million acres. The composition of that forest in terms of stand structure classes is very different from what was here in pre-settlement time (Fig. 6b, 2009–2013 FIA data, Laustsen, pers. comm.).

PRE-SETTLEMENT FOREST (BY AGE CLASS) IN THE NORTHEASTERN U.S.

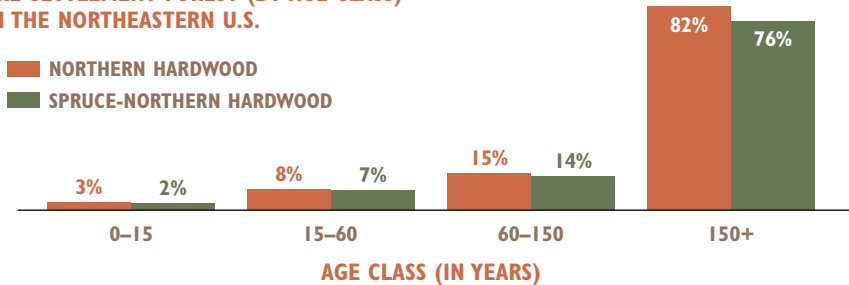


Figure 6a. The age composition of forests in the northeastern U.S. based on models using 50a-year (northern hardwood) or 545-year (spruce-northern hardwood) rotations and random spatial patterns (from Table 1 in Lorimer and White, 2003).

TODAY'S FOREST (BY STAND STRUCTURE CLASS) IN MAINE

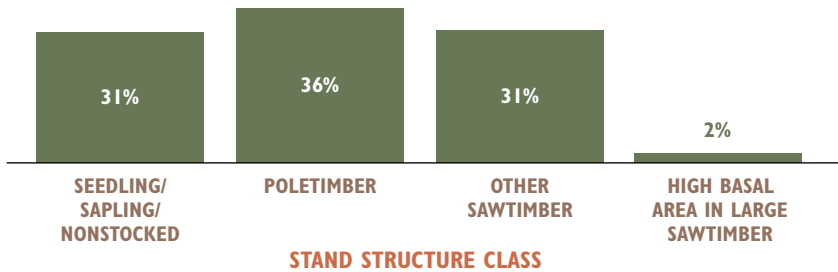


Figure 6b. The stand structure composition of Maine's current forestland calculated from recent (2009–2013) FIA data (Ken Laustsen, pers. comm.).

SOUTH AND NORTH

Not only are Maine's forests different today than they were in the past, they differ from south to north.

Southern Maine's forest has changed from an old-growth mixed hardwood forest in pre-settlement time to a network of suburban and rural forests today. In the four most southern counties (1.2 million forested acres in York, Cumberland, Lincoln, and Sagadahoc), poletimber and sawtimber stands comprise more than 85% of the total forest acreage. Young forests (seedling/sapling) and older forests (with high basal area in large sawtimber) each comprise less than 7% of the forest acreage (Fig. 7, FIA data, Ken Laustsen, pers.comm.).

Early successional forest birds experienced a population boom in southern Maine as a result of agricultural clearing and have lost habitat over the last century as farms have been abandoned and forests have grown back. With many small woodland owners today hesitant to cut trees, keeping sufficient young forest habitat in a matrix of older forest stands can be challenging. At the same time, birds that depend on larger trees and more complex structure may not find what they are looking for until these predominantly intermediate forests develop the characteristics of a more structurally complex older forest.

Northern Maine's forest has changed from an older, structurally heterogeneous spruce-hardwood forest in pre-settlement time to a more homogeneous, younger spruce-fir and mixed forest. Today, this forestland lacks the extensive human development that dominates much of the forested landscape in the southern part of the state.

With recent changes in northern forest landowners, operations, and economics, harvest practices have shifted to highly mechanized operations and shorter rotations. As a result, the acreage of mature forest (with high basal area in large sawtimber) has declined significantly to just over 2% of the forest today, and just over one third of the forest acreage is in young forest (seedling/sapling).

While many species use young forest habitat, the amount of young forest in northern Maine is well beyond what would be there in the absence of human activity. Managing for more balanced stand structure across the landscape would help improve habitat for a wide range of species, from those that use young forest to those that depend on structurally complex older forest, including all of the FFMB priority species.

STAND STRUCTURE CLASSES

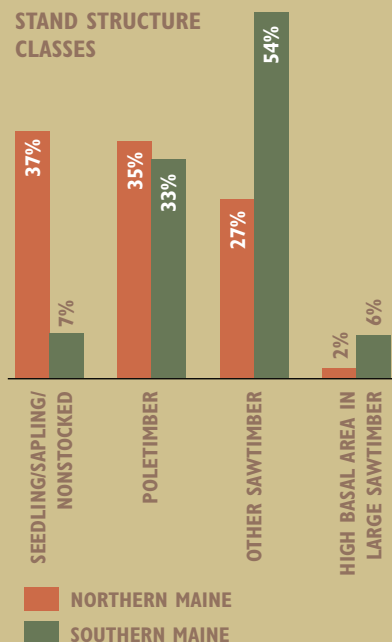


Figure 7. The stand structure composition of forestland in southern Maine (1.2 million acres in York, Cumberland, Sagadahoc, and Lincoln counties) compared to northern Maine (11.9 million acres in Aroostook, Penobscot, Somerset, Piscataquis, and Washington counties) calculated from recent (2009-2013) FIA data (Ken Laustsen, pers. com.). In addition to the acreage in the two regions, the graph illustrates the relative differences in how the range of stand structures vary between the two regions.

SPECIES INFORMATION PAGES

The following pages contain brief summary information for the 20 FFMB priority birds. References of source information are included in Appendix B. Full-size summary pages for each species are available online at maineaudubon.org/FFMB for inclusion in forest management plans. Information on each species includes:

Identification and Song

Description of the male breeding plumage and song. Females of most forest species do not sing, and most are much drabber in coloring than their male counterparts.

Nest Brief description of typical nest location and type, including general structure of nest (open cup, cavity, etc.).

Food Primary food source.

Territory Size Approximate area used by one breeding pair. Often varies depending on habitat quality, with larger territories in lower-quality habitat.

Forest Condition Brief description and illustration of habitat features needed to successfully breed and feed, and forest habitat used most often. Section III (*Maine's Forest Bird Habitat*) provides background on the forestry terms used in this section.

Forest Habitat Association

Along the edge of the page, there are four different Forest Habitat Associations (OP [Oak–Pine], NH [Northern Hardwoods], NM [Northern Mixedwoods] and NS [Northern Softwoods]). For more information, see Section III, p. 39.

Orange indicates preferred habitat, and tan indicates habitat that will be used in the absence of preferred habitat. If there are no preferred associations, the species is a generalist among the Habitat Associations highlighted in tan. White indicates forest habitat associations that are rarely used.

Forest Habitat Age Class

Also along the edge of the page are three general Forest Habitat Age Classes spanning younger to older forest as defined in Table 1. For more information, see Section III, p. 52. The same color scheme used for Habitat Associations applies (orange for preferred, tan for use in absence of preferred, white for rarely used).

Habitat Features

At the bottom of each page is a graphic depicting forest type, age, layer, and any special features where the bird and nest are typically found.

Table 1. Habitat Age Class characterizations

HABITAT AGE CLASS	STAGE	APPROX. AGE	TYPICAL DBH
Young	Seedling	0–10 years	<1"
	Sapling	10–25 years	1–5"
Intermediate	Poletimber	20–70 years	5–10"
Older	Small Sawtimber	70–100 years	10–16"
	Large Sawtimber	>100 years	>16"

Tab Key

FOREST HABITAT ASSOCIATION

- OP** — Oak-Pine
- NH** — Northern Hardwood
- NM** — Northern Mixedwood
- NS** — Northern Softwood

Preferred

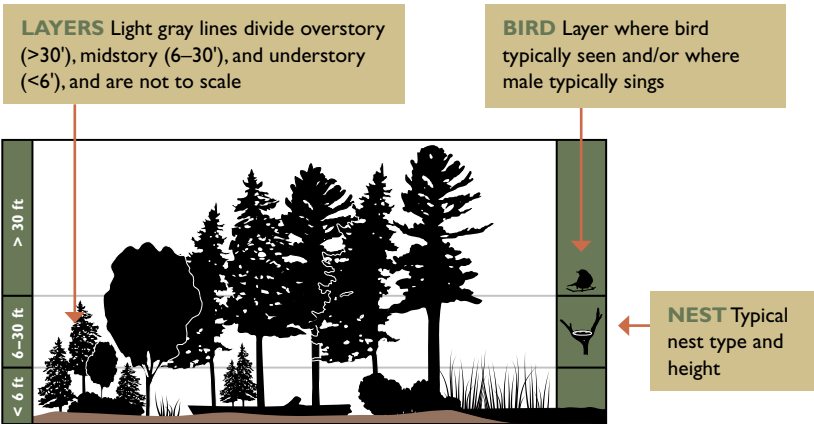
FOREST HABITAT AGE CLASS

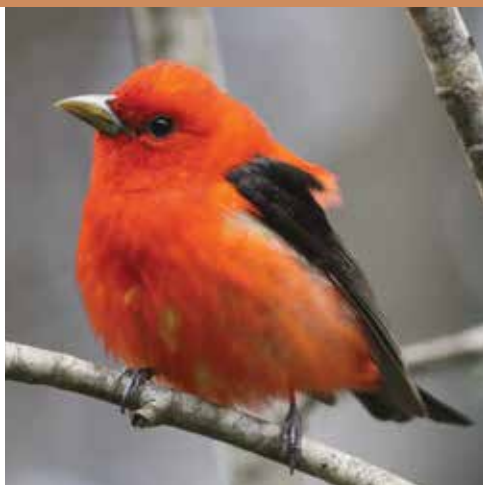
- Y** — Young
- I** — Intermediate
- O** — Older

Will Use

Rarely Used

HABITAT FEATURES





Scarlet Tanager

IDENTIFICATION AND SONG Slim, bright red with jet black wings and tail. Song a hurried, burry, repetitive warble, similar to a robin, often without pauses between up and down phrases. Call a distinctive *chick-burr*. Found statewide.

NEST Flimsy shallow cup usually placed among a cluster of leaves on a nearly horizontal branch in the canopy, well away from the trunk. Prefers hardwood trees, particularly oak.

FOOD Mostly insectivorous. Eats a wide variety of adult flying and non-flying insects, insect larvae, and spiders.

TERRITORY SIZE Highly variable, 1–12 acres with foraging areas much larger than mating and nesting areas.

FOREST CONDITION Prefers interior hardwood forests with >80% canopy cover, especially those with significant oak component. Sensitive to size of forest patch; at least 40 acres contiguous forest needed for successful breeding.



Ovenbird



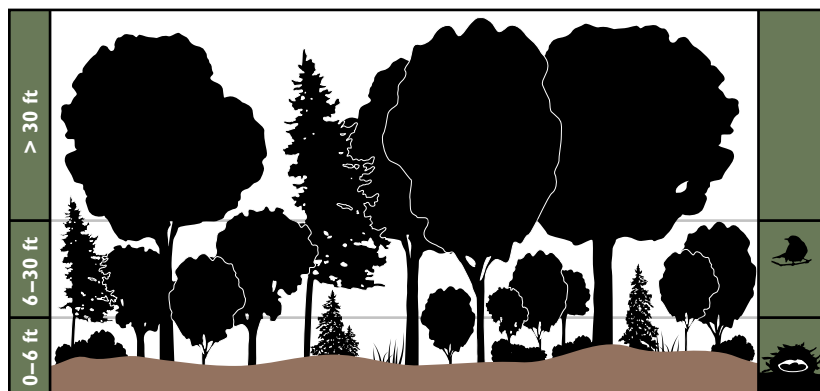
IDENTIFICATION AND SONG Large warbler, olive-green above, white below, with dark streaked spots on lower throat, breast and sides, conspicuous eye ring, and orange-brown crown bordered with black stripes. Song a loud and distinct staccato song *pizza, pizza, pizza* (or *teacher-teacher-teacher*). Found statewide.

NEST Domed or oven-shaped nest of dead leaves and plant fibers, lined with grass, placed on the forest floor with a side entrance.

FOOD Forest invertebrates, captured in the leaf litter on the forest floor.

TERRITORY SIZE 1.0–3.5 acres.

FOREST CONDITION Older, larger contiguous tracts of hardwood or mixedwood forest with 60–90% canopy cover and canopy heights >50'. Prefers areas with less ground cover and deeper leaf litter. Prefers large mature forest patches >250 acres where breeding success is higher.





Wood Thrush

IDENTIFICATION AND SONG Slightly smaller than a robin, with brown back, and heavily spotted white breast. Song a flute-like *ee-oh-lay-ee*, usually going up in pitch and ending in a sound like shattering glass. Found statewide.

NEST Open cup of leaves and grasses lined with mud, placed on lower limb of a tree or shrub 10–13' off the ground and well hidden among leaves in a shady area.

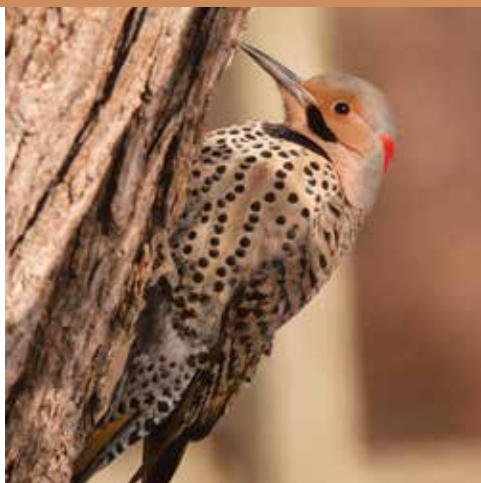
FOOD Mostly soil invertebrates, some fruits. Primarily forages on ground in leaf litter or on semi-bare ground under forest canopy.

TERRITORY SIZE 0.2–7.0 acres.

FOREST CONDITION Prefers interior forest stands with canopy >50' high, a diversity of hardwood tree species, moderate mid-canopy cover and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter. Effects of forest fragmentation varied and complex, but in general does better in larger blocks of contiguous forest.



Northern Flicker



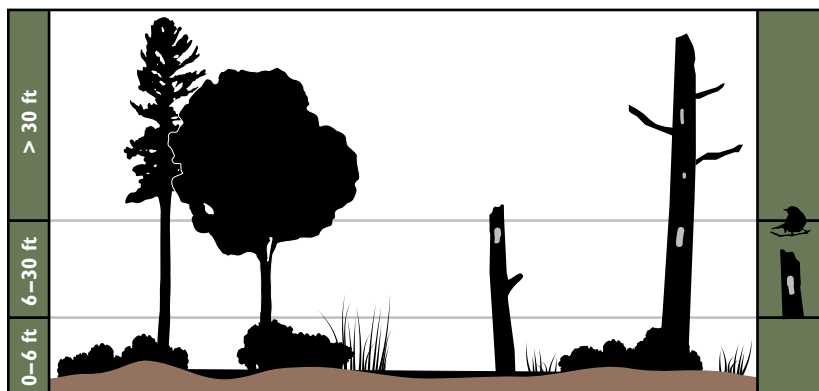
IDENTIFICATION AND CALL Large brownish woodpecker with dark bars and spots on back, whitish or buff breast with black spots and a black crescent mark on upper breast. White rump visible in flight, red patch on nape, yellow wing linings, and a black “mustache.” Call a loud, repeated *flicka-flicka-flicka*, also a loud *peough* call. Found statewide.

NEST Usually excavates nest cavities in dead/diseased trunks and large branches. Placement determined by suitability of soft wood, but many cavities between 20–25' high. Prefers aspen in northern forests. Uses natural cavities.

FOOD Forages primarily on the ground for ants and other invertebrates near forest edges or along roads.

TERRITORY SIZE Can range up to 60 acres but may concentrate in smaller foraging “hotspots” of 2–3 acres.

FOREST CONDITION Uses a wide range of open forest types but prefers more open, wetter areas near swamps or recently flooded areas lacking dense grass or ground cover. Prefers larger snags (>12" DBH), but will excavate cavities in dead branches or diseased live trees. Important “key-stone” species because large percentage of excavated nest cavities later used by many other wildlife.



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Chestnut-sided Warbler

IDENTIFICATION AND SONG Yellow crown, black moustache stripe, chestnut sides following contour of wings, and tail held cocked above wingtips. Song is a fast *please-please-pleased-to-MEET-cha* with emphatic ending. Found statewide.

NEST Open cup placed in crotch of small shrub or within a group of small-diameter, vertical stems less than 6' off ground.

FOOD Insectivorous; prefers caterpillars and fly larvae.

TERRITORY SIZE 1–3 acres.

FOREST CONDITION Historically relied on natural disturbances that created patches of younger forest habitat within a matrix of older forest. Typically found in young (5–15 year old) hardwood forest gaps or cuts that have an open canopy (<30% cover) and dense shrubs and saplings 3–10' high for nesting and foraging. Some larger saplings used as singing perches and to hide nests.



Mourning Warbler



IDENTIFICATION AND SONG Olive above and bright yellow below with a gray hood, no eye ring, and black patch below throat. Loud, ringing, musical song, *teedle-teedle*, *turtle-turtle* (or *cheery-cheery*, *chory-chory*), the last pair of notes lower. Found primarily in northern and central Maine.

NEST Usually placed on or near the ground in dense vegetation, among ferns or in grassy tussocks, rarely more than 3' above ground.

FOOD Largely insectivorous during breeding season, consuming beetles, spiders, other insect larvae, usually low (<6') in trees and shrubs.

TERRITORY SIZE 1–2 acres.

FOREST CONDITION Younger forest or forest gap species, uses clearings with dense understory growth and open or intermediate canopy (40–70%). Highest densities 2–10 years after harvest.

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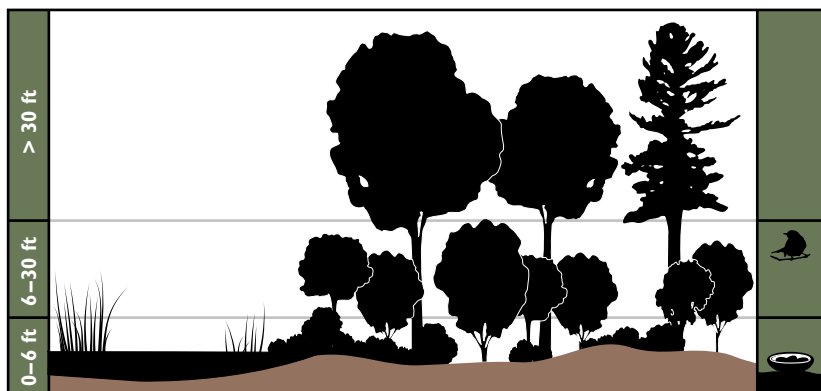
IDENTIFICATION AND SONG Tawny-brown above, weakly spotted on breast, least spotted of all the thrushes. Flute-like and ethereal song, like a marble spiraling down a drainpipe, with no introductory notes. Typically four distinct downward phrases — *VEER-Veer-Veer-veer*. Found statewide.

NEST Cup of dead leaves, bark and mud-like leaf mold lined with fine fibers, placed on ground or in a low shrub or brush pile.

FOOD Insects, spiders, centipedes, pill bugs, and fruits. Primarily forages on the ground but also in the foliage.

TERRITORY SIZE 0.25–7.50 acres.

FOREST CONDITION Damp hardwood forest with intermediate (30–80%) canopy cover and a dense understory (0–6'). Often associated with riparian areas, regenerating forests, and beaver wetlands.



Yellow-bellied Sapsucker



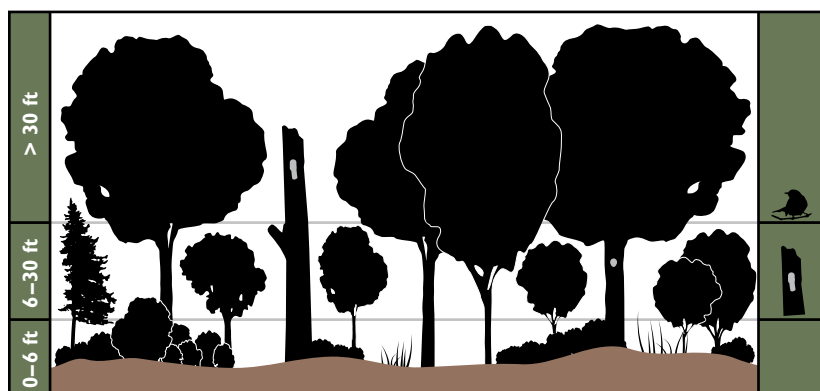
IDENTIFICATION AND CALL Smaller black-and-white patterned woodpecker with black bib and pale yellow wash on breast, red forehead and throat, and long white stripe along wing. Call a repeated nasal *mew* or a squealing *quee-ah*. Drumming more irregular and slower than other woodpeckers, often in bursts of five rapid taps followed by slower double taps, sounding like Morse code. Found statewide.

NEST In tree cavity with small entrance. Often uses live hardwood trees with heartwood decay that makes excavation easier.

FOOD Feeds on sap from a variety of woody plant species, insects, fruits, and seeds. Drills neatly organized rows of sap wells along trunks.

TERRITORY SIZE Variable, 2.5– 7.5 acres.

FOREST CONDITION Prefers high percentage of *shade-intolerant* species, especially larger aspen, alder and birch. Requires hardwoods with central decay column or snags for nest cavities.





American Woodcock

IDENTIFICATION AND SONG Plump, round forest-dwelling bird with long bill, virtually no visible neck, short legs, and mottled cryptic coloration. Numbers peak during fall migration. Nasal *peent* call heard at dusk along with a twittering wing sound during flight displays. Found state-wide.

NEST Scrape in dead leaves on the ground.

FOOD Primarily invertebrates on forest floor and in soil, including insects and earthworms, rarely plant material. Old agricultural sites are often ideal habitat for earthworms, which were introduced in the 18th century.

TERRITORY SIZE Males defend small areas within singing grounds, with multiple males sharing a ¼ to ½ acre opening with little or no cover, within 300' of patches of dense shrubs used for daytime cover.

FOREST CONDITION Complex mix of small openings and younger forest in early stages of regeneration (<20 years old) for singing and displays; patches of dense shrubs for daytime cover; and young, dense sapling stands for raising young. Different habitat used at different times of year and day.



Eastern Wood-Pewee



IDENTIFICATION AND SONG Slender, small-headed flycatcher, grayish-olive above with dull, white wing-bars. Song a plaintive *pee-ahh-weeeee*. Found statewide.

NEST Shallow cup of woven grass covered on outside with lichens and placed on the horizontal limb of a tree.

FOOD Insects, caught on the wing by flying out from a perch and back again.

TERRITORY SIZE Highly variable, 1–20 acres.

FOREST CONDITION Generalist, associated with small gaps, openings, or edges within hardwood forests with moderate canopy cover (50–70%) and open midstory (6–30' layer).

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Canada Warbler

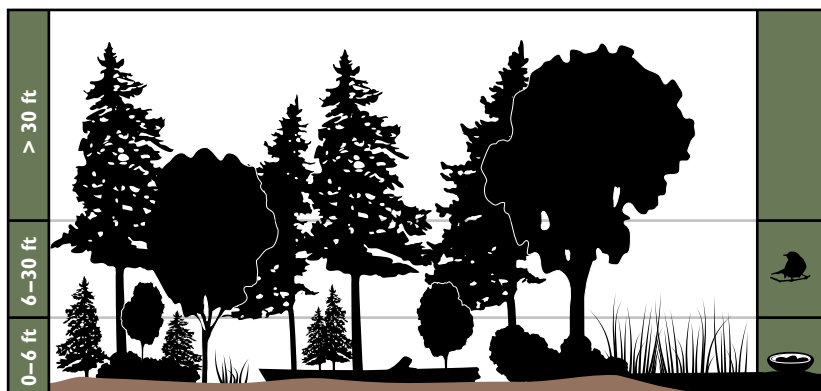
IDENTIFICATION AND SONG Necklace of black stripes on bright yellow throat and belly, gray back, and complete white eye ring. Song often has soft introductory chips, *I'm-IN-here, but-you-CAN'T-SEE-ME*. Found statewide.

NEST Open cup on or near ground on mossy hummock, stump, log, or upturned tree roots.

FOOD Flying insects and spiders.

TERRITORY SIZE 0.5–3.0 acres, larger for younger males than older males in New Hampshire.

FOREST CONDITION Most abundant in moist mixedwoods with 50–70% canopy cover and dense understory (0–6') and midstory (6–30'). Often found in swamps, riparian areas, and upland forests with mossy hummocks, root masses, and downed logs. Uses small gaps, woody material, tip-ups, and downed logs, especially near wet areas.



Black-throated Blue Warbler



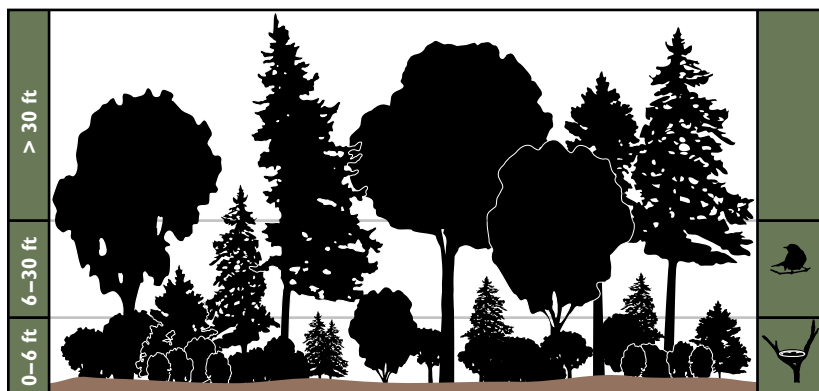
IDENTIFICATION AND SONG Deep blue on top with black mask and throat and white wing-patch. Song is a thick and buzzy *I'm-so-la-zeee* (or *beer-beer-beer-beeee*) with endnote rising up to the “blue” sky. Found statewide.

NEST Open cup of bark strips and vegetation, often bound together with spider web and placed in the fork of a sapling or shrub within a dense shrub understory (0–6').

FOOD Insectivorous, feeding largely on moth and butterfly larvae and adults.

TERRITORY SIZE From 2.5–10 acres, smaller where there is dense/diverse understory.

FOREST CONDITION Prefers larger contiguous tracts (>250 acres) with 50–80% canopy cover, trees >40' tall, and a variety of tree sizes and ages. Prefers dense understory of hobblebush and/or small saplings of sugar maple, striped maple, beech, or softwoods.





Bay-breasted Warbler

IDENTIFICATION AND SONG Small forest songbird with a chestnut cap, throat, and sides, blackish face with conspicuous cream-colored patch on back and side of neck, gray back with black stripes, and two broad, white wingbars. Song is a high thin *teesi-teesi-teesi-teesi*, without change in pitch or volume. Found in all but extreme southern Maine.

NEST Open cup located on horizontal branch of dense conifer 16–25' above ground, usually in spruce or fir, but occasionally in pine or hardwood.

FOOD Insects and spiders. Spruce budworm specialist.

TERRITORY SIZE 4–9 acres, much smaller (0.5 acres) during budworm outbreaks.

FOREST CONDITION Dense softwood specialist; prefers older stands. May breed in younger mixedwood stands during spruce budworm outbreaks. May be sensitive to forest composition across the landscape.



Northern Parula



IDENTIFICATION AND SONG Small warbler, mainly blue-gray above with two conspicuous white wing-bars, a partial white eye-ring, light greenish-yellow triangular patch on back; throat and breast yellow; belly white. Song a series of one or more rising buzzy notes dropping abruptly at the end, *bzzzzz-zip* or *bz-bz-bz-zip*. Found statewide.

NEST Most nests built in hanging bunches of bearded lichen (*Usnea* spp.), so the presence of these epiphytes is critically important. Preferred nest sites usually near water. Nests tend to be located at the end of a branch, usually 10–20' high.

FOOD Primarily gleans insects and spiders, sometimes eats berries or seeds.

TERRITORY SIZE 0.5–1.0 acre.

FOREST CONDITION Prefers tall, older softwood forests (especially spruce, fir, and hemlock) in moist habitats where bearded lichen (*Usnea* spp.) is abundant, including riparian areas, coastal forests, bogs, and swamps. Prefers canopy cover >80% and tall trees (>50'). Will use hardwood and mixedwood forests of varying age throughout range. Prefers large forest blocks (>250 acres).





Black-throated Green Warbler

IDENTIFICATION AND SONG Bright yellow face, olive head and back, black throat drips down sides onto white belly, and two white wing bars. One of the easiest warblers to identify with a buzzy *zee-zee-zee-zoo-zee* (or *zoo-zee-zoo-zoo-zee*) song. Found statewide.

NEST Open cup typically placed close to trunk where two or more small branches fork out of trunk, usually in conifers, 3–10' from ground.

FOOD Insectivorous; gleans insects from small branches and needles on conifers.

TERRITORY SIZE Average of 1.6 acres in hemlock-beech stands in New York, as small as 0.6 acres in favored spruce habitat.

FOREST CONDITION Prefers closed canopy (>80% cover) with trees >4" DBH and >50' tall and dense understory (3–10') as well as multiple vertical canopy layers. Prefers large, contiguous forest tracts (>250 acres). Avoids road edges and gaps 80–130' wide. Returns to regenerating softwood sites 10+ years after partial cutting. Uses softwood patches in hardwood stands, especially hemlock.



Blackburnian Warbler



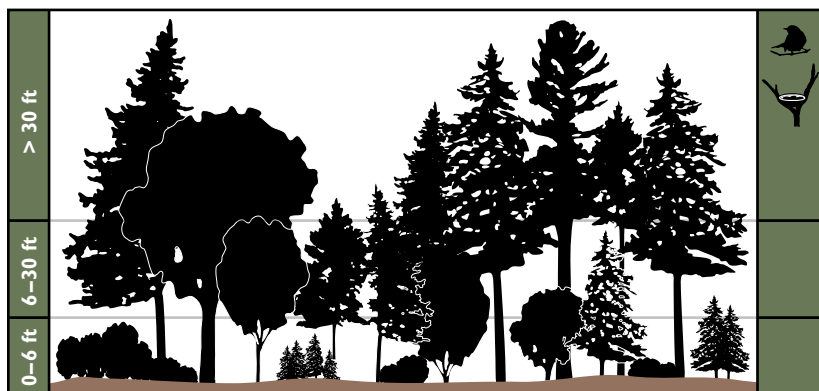
IDENTIFICATION AND SONG Black and white with vivid orange throat, crown patch, and eyebrow, large white wing patch, and boldly striped back. Song thin and wiry, increasing in speed and rising to the limit of hearing, *sleet-sleet-sleet-sleet-sleetee-sleeeee*. Found statewide.

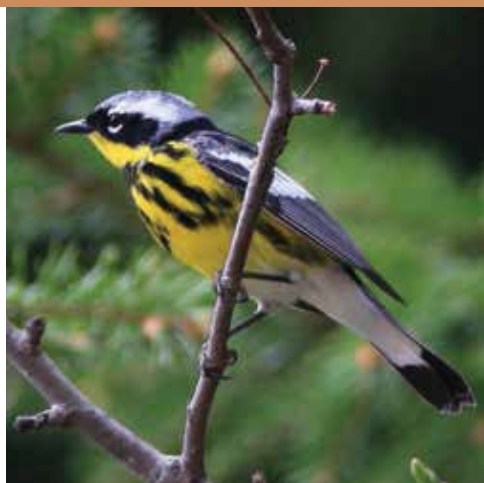
NEST Well-concealed open cup in conifer. Placed on limb away from trunk, sometimes near end of branch, often >30' above forest floor.

FOOD Insectivorous; often spiders, beetles, and moth larvae.

TERRITORY SIZE 1–3 acres, smaller in softwoods.

FOREST CONDITION Older softwood or mixedwood forests with high canopy cover (>80%) and tall trees (>40'). Especially sensitive to removal of large conifers. Uses topmost part of tall trees (especially tallest trees that emerge above the main canopy) for feeding, nesting, and singing. Requires fairly dense vegetation in midstory. Prefers forests interiors.





Magnolia Warbler

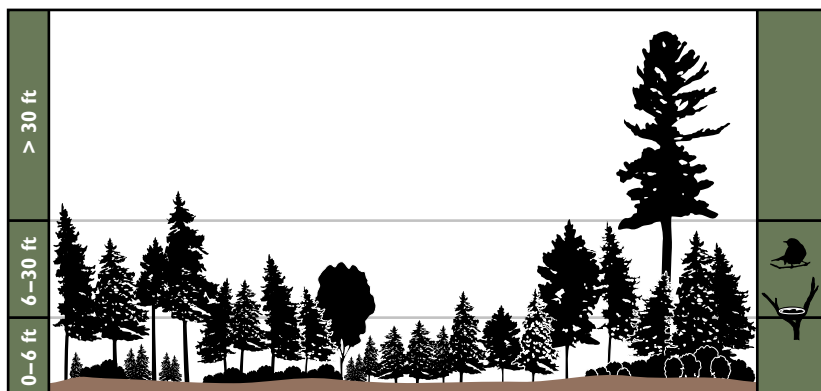
IDENTIFICATION AND SONG Black mask, white eyebrow stripe, conspicuous black band across the upper breast, with heavy black streaks on the sides, wide white wing-panels, a black back, and yellow rump. Song short and weak whistled *weta, weta, WETEEA*. Found statewide.

NEST Well-concealed nest built on a horizontal branch, usually near trunk and less than 10' above ground in dense coniferous vegetation.

FOOD Gleans arthropods, with caterpillars constituting majority of food volume. Takes appreciable numbers of spruce budworms.

TERRITORY SIZE 1–2 acres.

FOREST CONDITION Presence of young conifers essential. Prefers small, close-growing, young conifers in either softwood or mixedwood stands; 30–60% canopy cover and dense understory.



Black-backed Woodpecker



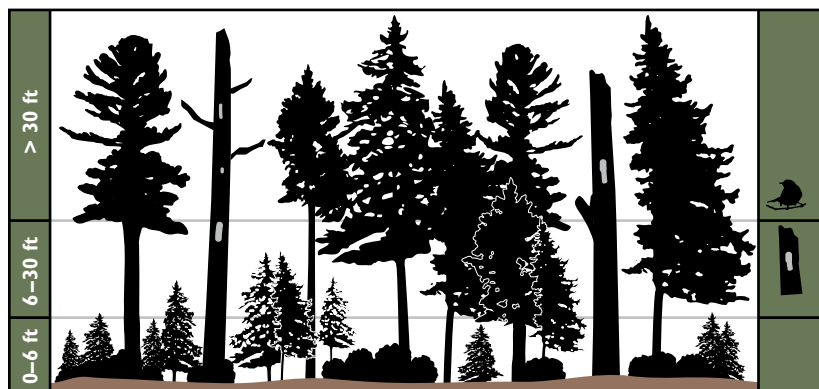
IDENTIFICATION AND SONG Robin-sized woodpecker with solid black back, barred sides, and white chest. Male has yellow crown. Calls are a sharp, fast, harsh *kyik* and a scolding rattle. Also regular drumming like other woodpeckers. Uncommon year-round resident in Northern Maine.

NEST Excavates cavity in relatively sound, tall conifer snags, rarely in live trees.

FOOD Excavates under loose bark of softwoods for wood-boring beetle larvae.

TERRITORY SIZE Average of 370 acres in Quebec.

FOREST CONDITION Prefers flooded, burned, or old spruce-fir forests with available cavity trees (>12" DBH, >60' tall, relatively sound softwoods preferred), where tree mortality has led to an abundance of wood- and bark-boring insects. Prefers foraging in areas dominated by tall conifers and medium or higher canopy cover (>50%).





Boreal Chickadee

IDENTIFICATION AND SONG Similar to more common Black-capped Chickadee but crown and back brown and sides reddish brown. Song a husky, buzzy *zick-a-zee-zee*, lazier and more nasal than call of Black-capped Chickadee. Year-round resident of northern Maine.

NEST Uses cavities in snags, stumps, or branch stubs with soft heartwood. May excavate new cavity or use existing woodpecker or natural cavity of appropriate size. No evidence for tree species preference. Cavities usually <10' from ground.

FOOD Seeds, berries, variety of insects.

TERRITORY SIZE Can be over 10 acres.

FOREST CONDITION Prefers older forests with >80% canopy cover and tall (>50') conifer trees, though found in younger coniferous forests with available cavity or decaying trees. Prefers spruce and balsam fir. Typically replaced by Black-capped Chickadee in mixedwoods.



Olive-sided Flycatcher



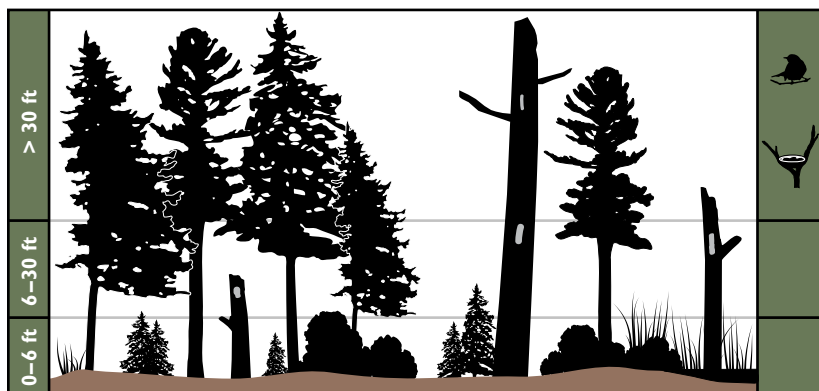
IDENTIFICATION AND SONG Inconspicuous, large-billed, heavy-headed, deep olive-brown, with darker sides, separated by white patch down center of breast. Tail broad and prominently notched. Song a loud, resounding *quick, THREE beers*, often sung from high perch on large tree or snag. Found statewide.

NEST Loosely formed nests usually well out from tree trunk of conifer in cluster of live needles and twigs.

FOOD Typically forages near or above canopy, sallying forth to catch flying insects. Generally sits on prominent perch, often at top of snag or dead tip of uppermost branch of tall tree, before and after capturing prey.

TERRITORY SIZE 25–50 acres.

FOREST CONDITION Associated with peatlands, forest openings, forest edges, or managed stands with canopy gaps. Presence in younger forests dependent on availability of snags or residual tall trees for foraging and singing perches. Frequently observed along wooded river and lake shorelines, possibly because of higher insect abundance.



III. Maine's Forest Bird Habitat

OVERVIEW

The FFMB approach connects the habitat structures and functions of different forests and landscapes with the needs of priority forest birds. By knowing what birds need, foresters can create or enhance forest habitat and contribute to the long-term conservation of priority forest birds while at the same time generating income and meeting other landowner objectives.

The variety of physical structures found in the forest is critically important to forest birds. The species of trees present; tree height and diameter; density of overstory, midstory, and under-story vegetation; and the presence of dead wood (standing snags and downed woody material) all help determine which species of birds use a particular forest stand. These

aspects of forest habitat vary across forest ages and types, as well as forest management practices. Guidance on assessing these aspects can be found in Section IV, *FFMB Habitat Assessment*, p. 66.

In addition to the structures within any particular forest, the landscape surrounding the forest often contributes to habitat suitability and even productivity. Foresters working in smaller woodland ownerships may not be able to address the needs of area-sensitive species or those that need large blocks of forest interior. However, foresters can assess forest management options in any given stand in the context of the surrounding landscape when managing forests “with birds in mind.” More details and guidance on how to assess landscape context can be found starting on page 76.



BIG, TALL OAK TREES: SCARLET TANAGER

Scarlet Tanagers prefer interior hardwood forest with a dense canopy of tall oak trees, where they can find abundant caterpillars to feed their young.



FRAGMENTATION: WOOD THRUSH

Wood Thrush are interior forest birds. They have smaller territories and produce more chicks in larger blocks of contiguous forest (>250 acres). Once larger forest blocks are broken up by roads, development, or agriculture, territory size increases, and nests are less productive.

Wood Thrush will nest near edges and in smaller forest blocks, but they are often less successful.

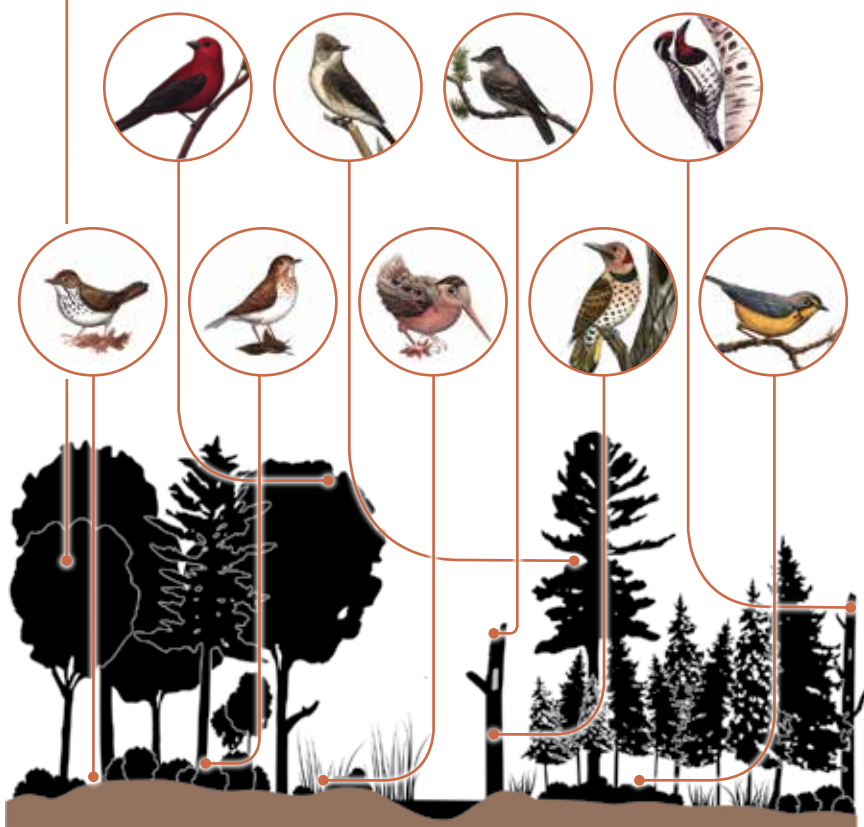


Figure 8. Where in the woods? Each of the 20 FFMB species uses a different part of a structurally diverse forest, both vertically and horizontally.



YOUNG SOFTWOOD SPECIALIST: MAGNOLIA WARBLER

Magnolia Warblers nest deep within small clusters of dense young conifers. They will not nest in hardwood trees or older softwood trees, as both lack dense cover. Historically, natural disturbances such as wind, fire, and disease created canopy gaps that fostered the development of this habitat amid a matrix of older forest. Today, forest management can create favorable habitat conditions.

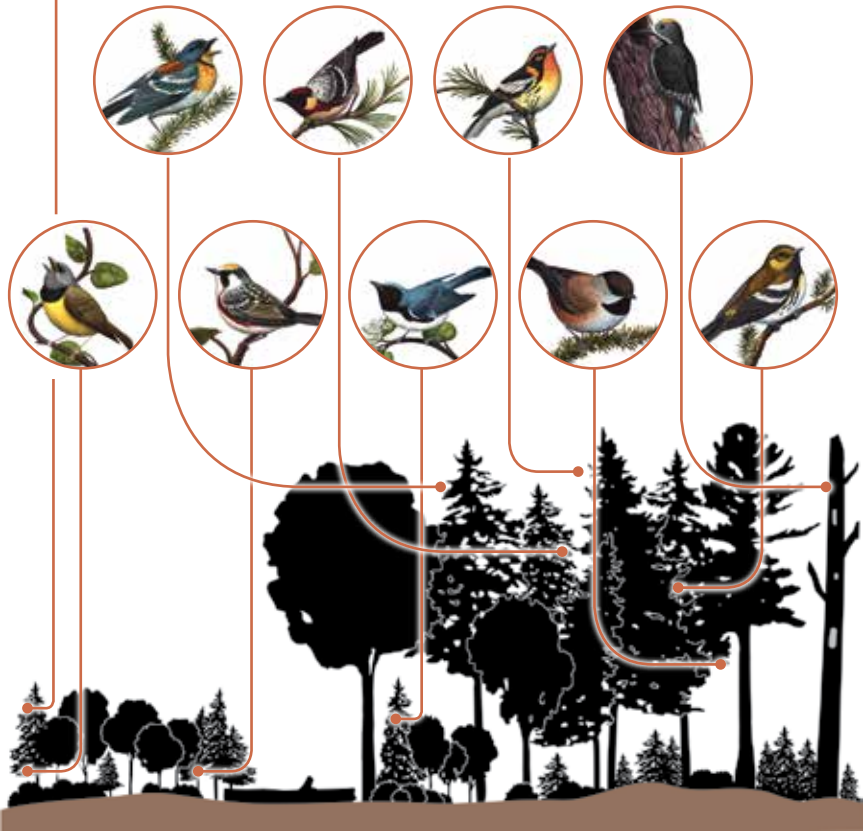


Figure 8. Where in the woods? (Cont'd)

FOREST HABITAT ASSOCIATIONS AND FOREST TYPES

There are many systems for describing and classifying forests. This guidebook uses **forest habitat associations**, groups of related forest types that frequently grow near each other on the landscape (Table 2). This system covers most forest bird and wildlife habitat preferences, and is simple enough that it can be cross-referenced with other forest type systems commonly used by foresters. Forest landowners will also be able to classify forests fairly easily using these associations.

Forest classification systems are simply tools to help describe and manage forests. No classification system is perfect, and defining types that occur along a natural gradient can be arbitrary. Forests that do not fit neatly into one particular type in this guide are likely to be encountered. Sometimes the least complicated system — “younger hardwoods” vs. “older mixedwood” — is all that is needed to assess general bird habitat features and apply FFMB management strategies.

Table 2. Common forest types in each of the four Forest Habitat Associations used in FFMB assessment and management.

FOREST HABITAT ASSOCIATION	COMMON FOREST TYPES
Northern Hardwoods¹ <i>May include up to 25% softwoods</i>	Northern Hardwoods (beech–birch–maple and variants) Aspen–Birch
Northern Mixedwoods² <i>Neither hardwoods nor softwoods exceed 75% of stocking</i>	Northern Hardwood/Hemlock Northern Hardwood/Spruce–Fir Hemlock (in patches) Aspen–Birch
Northern Softwoods³ <i>May include up to 25% hardwoods</i>	Spruce–Fir Spruce–Hemlock Northern White Pine–Mixed Conifer Northern White Cedar Aspen–Birch (early successional)
Oak–Pine⁴ <i>May range from pure oak-dominated hardwoods to mixed hardwood and softwood stands</i>	Northern Red Oak Red Oak–Mixed Hardwoods Red Oak–White Pine–Red Maple White Pine Hemlock and Hemlock–Oak–Pine

¹ May include forest types from the USDA Maine Forest Inventory and Analysis (FIA) 800 (Maple/Beech/Birch Group), 960 (Other Hardwoods Group) and 900 (Aspen/Birch Group).

² May include (FIA) groups 700 (Elm/Ash/Cottonwood Group), 900 (Aspen/Birch Group), and 999 (Nonstocked).

³ May include (FIA) groups 120 (Spruce/Fir Group) and 900 (Aspen/Birch Group).

⁴ May include (FIA) groups 100 (White/Red/Jack Pine Group), 160 (Loblolly/Shortleaf Group), 400 (Oak/Pine Group) and 500 (Oak/Hickory Group).

Northern Hardwood Association



- **NORTHERN HARDWOODS (BEECH-BIRCH-MAPLE AND VARIANTS)**
- **ASPEN-BIRCH**

IDENTIFICATION Hardwood species comprise at least 75% of the stocking, with sugar maple, yellow birch, and American beech as characteristic species and paper birch, aspen, red oak, hemlock, and red spruce as common associates. Beech and red maple may be dominant on poor sites, while sugar maple, ash, and basswood are found on highly enriched sites. Young forest stages may be dominated by aspen (popple) and paper birch. This association currently covers approximately 7 million acres in Maine.

ECOLOGY Northern hardwood forests are typically found at middle elevations on moist, medium- to well-drained sites. Over time, late-successional stages of this type form large, relatively stable forests. Under natural conditions, shade-tolerant northern hardwoods are most commonly regenerated in small canopy gaps created by windthrow or mortality caused by insects and disease. This association is known for an abundance of spring wildflowers. There is often a transition to spruce-fir at high elevations, along drainages, and in less well-drained soils.

WILDLIFE Northern Hardwoods host a great variety of resident and migratory birds and other wildlife (Table 3). The *hard mast*, or tree nuts, produced by beech and oak are an important food source for many wildlife species, though trees do not start producing large amounts of mast before age 40. Beechnuts are critical to the reproductive success of black bear in northern Maine.



Table 3. Selected Northern Hardwood Habitat Association Species (see also Summary Table, p.102-103).

FFMB PRIORITY SPECIES	KEY HABITAT FEATURES
Black-throated Blue Warbler	Dense understory of hobblebush or other shrubby species
Chestnut-sided Warbler	Gaps with regeneration
Mourning Warbler	Dense regeneration
Ovenbird	Mature forest, abundant leaf litter, little ground cover
Scarlet Tanager	Forest interior; tall trees (especially oaks), closed canopy
Veery	Sapling patches and riparian areas
Wood Thrush	Tall trees, dense leaf litter
Yellow-bellied Sapsucker	Snags, especially Aspen-Birch
SELECTED WILDLIFE SPECIES	KEY HABITAT FEATURES
Barred Owl	Large cavity trees
Broad-winged Hawk	Small gaps
Northern Goshawk	Mature trees
Pileated Woodpecker	Large decaying trees or snags
Rose-breasted Grosbeak	Dense hardwood thickets/sapling stands
Black Bear	Hard mast, especially beechnuts
Fisher	Hollow trees and logs, dense regenerating softwoods
Mink	Hollow logs, natural cavities, riparian areas
Porcupine	Larger den trees

Northern Mixedwood Association



- **NORTHERN HARDWOOD/HEMLOCK**
- **NORTHERN HARDWOOD/SPRUCE-FIR**
- **HEMLOCK (IN PATCHES)**
- **ASPEN-BIRCH**

IDENTIFICATION Northern Mixedwood includes forest types that are transitional between Northern Hardwood and Northern Softwood types. Neither hardwoods nor softwoods make up more than 75% of the stocking. Typical hardwood species may include sugar maple, red maple, yellow birch, paper birch, American beech, aspen, and red oak. Softwoods may include hemlock, red spruce, white spruce, balsam fir, and northern white cedar. Aspen (popple) and paper birch may dominate young forest stages. See Oak–Pine Association for mixed hardwood-softwood types in landscapes where oak is a significant component. Northern Mixedwoods currently cover approximately 2.5 million acres in Maine.

ECOLOGY Northern Mixedwoods are typically found on moist, medium to somewhat poorly-drained sites throughout the state, forming a transition zone between hardwood and softwood sites. Hardwood and softwood dominance may shift over time, and on enriched sites, harvesting and other disturbances often promote hardwood dominance. Mixedwoods are common on intermediate-quality sites at lower elevations.

WILDLIFE Northern Mixedwoods host a great variety of resident and migrant songbirds, with species characteristic of both Northern Hardwood and Northern Softwood forests potentially present (Table 4).



Table 4. Selected Northern Mixedwood Habitat Association Species (see also Summary Table, p. 104-105).

FFMB PRIORITY SPECIES	KEY HABITAT FEATURES
American Woodcock	Small clearings, dense undergrowth
Bay-breasted Warbler	Dense conifers
Black-throated Green Warbler	Hemlock
Black-throated Blue Warbler	Dense understory of hobblebush or other shrubby species
Canada Warbler	Wet areas with small gaps
Eastern Wood-Pewee	Small gaps
Yellow-bellied Sapsucker	Snags, especially aspen-birch
OTHER WILDLIFE SPECIES	KEY HABITAT FEATURES
Barred Owl	Large cavity trees
Blue-headed Vireo	Dense hardwood thickets/sapling stands
Northern Goshawk	Mature trees
Pileated Woodpecker	Large decaying trees or snags
Red-breasted Nuthatch	Conifer component
Hermit Thrush	Dense conifers, closed canopy
Fisher	Hollow trees and logs, dense regenerating softwoods
Snowshoe Hare	Dense hardwood or softwood regeneration
White-tailed Deer	Adequate winter browse, conifer cover to reduce snowpack
Wild Turkey	Hard mast, forest openings or gaps

Northern Softwood Association



- **SPRUCE-FIR**
- **NORTHERN WHITE PINE-MIXED CONIFER**
- **SPRUCE-HEMLOCK**
- **NORTHERN WHITE CEDAR**
- **ASPEN-BIRCH (EARLY SUCCESSIONAL)**

IDENTIFICATION Softwood species comprise at least 75% of the stocking. Spruce-Fir is the most common forest type within this association. Northern Softwoods are typically characterized by mixtures of red spruce, white spruce, or black spruce and balsam fir in pure stands or with other species. Common associates include yellow birch, paper birch, and other northern hardwood species as well as hemlock, northern white cedar, and white pine. This association currently covers close to 6 million acres in Maine.

ECOLOGY Spruce-Fir and other Northern Softwood forest types frequently share the same landscape as Northern Hardwoods, but are found on cooler sites—notably valley bottoms, high-elevation areas, and along the coast—or where soils are somewhat poorly to poorly drained. Stands dominated by white spruce are common on former agricultural land in northern and eastern Maine as well as in the spray zone on coastal islands.

WILDLIFE Several bird species—including Spruce Grouse, Gray Jay, Black-backed Woodpecker, and Bay-breasted, Magnolia and Cape May Warblers—are found almost exclusively in Spruce-Fir forests. American marten is strongly associated with this forest type, either in pure stands or in Mixed Hardwood Spruce-Fir forests. Younger Spruce-Fir is critical for snowshoe hare, the primary prey of Canada lynx. Relatively mature to mature stands are critical deer wintering areas in northern Maine (Table 5).



Occurrence
of Northern
Softwood

Table 5. Selected Northern Softwood Habitat Association Species (see also Summary Table, p.106-107).

FFMB PRIORITY SPECIES	KEY HABITAT FEATURES
Bay-breasted Warbler	Dense conifers
Blackburnian Warbler	Tall trees, large hemlocks
Black-backed Woodpecker	Large dead/dying trees
Boreal Chickadee	Snags
Magnolia Warbler	Dense conifer understory regeneration
Northern Parula	Moist forest, bearded lichen
Olive-sided Flycatcher	Gaps and snags
OTHER WILDLIFE SPECIES	KEY HABITAT FEATURES
American Three-toed Woodpecker	Large decaying trees, black spruce stands
Cape May Warbler	Tall stands of spruce, budworm specialist
Spruce Grouse	Dense conifers with low branches
White-throated Sparrow	Open forest with brushy clearings
Merlin	Open forest, old crow nests or cavities
American Marten	Hollow trees and logs, dense regenerating softwoods
Northern Flying Squirrel	Cavity trees
Snowshoe Hare	Dense hardwood or softwood regeneration
Moose	Wetlands
White-tailed Deer	Adequate winter browse, conifer cover to reduce snowpack

Oak-Pine Association



- **NORTHERN RED OAK**
- **RED OAK–MIXED HARDWOODS**
- **RED OAK–WHITE PINE–RED MAPLE**
- **WHITE PINE**
- **HEMLOCK AND HEMLOCK–OAK–PINE**

IDENTIFICATION Northern red oak and white pine are the characteristic species, with stands ranging from pure oak to pure pine. Common associates include red maple, white ash, eastern hemlock, paper and yellow birch, sugar maple, and beech. Beyond the range in which red oak is common, stands with a significant white pine component should be considered part of the Northern Softwoods association (e.g. white pine-mixed northern conifer forests) and stands with a minor red oak component should be classified with the Northern Hardwood or Northern Mixedwood associations. This association currently covers approximately 1.8 million acres in Maine.

ECOLOGY Most Oak-Pine sites were cleared in the 17th and 18th centuries for fields or pasture. Stands dominated by white pine are found on sites that were most recently fields and on well-drained to excessively drained sand and gravel. The driest sites tend toward pitch pine in the southwest or red pine further north in Maine. The occurrence of red maple increases with soil moisture. Under natural conditions, stand-replacing disturbances caused by fire or wind may have been instrumental in maintaining Oak-Pine forests. Burning by Native Americans may have also played a role in maintaining this association. Gray squirrels aid regeneration by burying acorns which if not recovered, will sprout the following spring.



WILDLIFE Oak–Pine is the primary forested wildlife habitat in many parts of southern and central Maine. Acorns are a key food for deer, bear, Wild Turkey, and many other species. Large blocks of Oak–Pine forest are important to species such as Northern Goshawk, Wood Thrush, and Scarlet Tanager (Table 6).

Table 6. Selected Oak-Pine Habitat Association Species (see also Summary Table, p.108-109).

FFMB PRIORITY SPECIES	KEY HABITAT FEATURES
Blackburnian Warbler	Tall spires (above canopy)
Eastern Wood-Pewee	Small gaps (< 2 acres)
Northern Flicker	Snags, open forest
Ovenbird	Mature forest, abundant leaf litter; little ground cover
Scarlet Tanager	Forest interior, tall trees (especially oak), closed canopy
Veery	Sapling patches and riparian areas
Wood Thrush	Tall trees, dense leaf litter
OTHER WILDLIFE SPECIES	KEY HABITAT FEATURES
Cooper’s Hawk	Large decaying trees
Eastern Towhee	Dense, brushy understory; gaps
Northern Goshawk	Mature trees
Pine Warbler	Tall pines, little undergrowth
Eastern Milk Snake	Slash or debris piles
Gray Fox	Mix of forest and old fields
White-tailed Deer	Adequate winter browse, conifer cover (reduced snowpack)
Wild Turkey	Hard mast, forest openings or gaps

FOREST HABITAT STRUCTURES IMPORTANT TO PRIORITY FFMB SPECIES

Each bird species in Maine's diverse forest prefers to feed, rest and nest in slightly different spaces. This reduces potential conflicts with neighbors and allows many different species to coexist within the same area. The types of trees found in a stand—the Forest Habitat Associations outlined in the previous section—are just one aspect of habitat that determine which bird species likely use a particular forest stand.

The following pages discuss additional habitat features most important to the 20 priority FFMB species identified in Section II (Table 7). These habitat features are also associated with many other species of wildlife.

All of these features contribute to the physical structures that birds need. Most features will develop over time as healthy forests age. While young forest is important for several FFMB

AMERICAN MARTEN NEED FOREST STRUCTURE



Physical structure at the stand level is more important to American marten than forest age or species composition alone. Forests managed for physical and vertical structures characteristic of an older forest support American marten and will provide habitat for more than 70% of other vertebrate wildlife species. Providing this varied physical structure is also a focus of the FFMB approach. Marten need relatively high levels of vegetation cover in mid- and overstory layers so they can jump from tree to tree and escape predators. They use piles of coarse woody material as places to find prey and rest, especially in winter. For more information, see p. 89.

species, the focus of FFMB is promoting larger forest blocks with more mature forest structure. Creating small patches of young forest within this broader matrix of more mature forest will more closely mimic presettlement forest conditions and will provide the diversity of habitats that many birds and other wildlife need.

The following sections focus on ecological and habitat values. See Section V, *Managing Forests with Birds in Mind*, p. 76, for recommendations on managing for the forest habitat structures described in this section.

Table 7. Overview of key habitat structures and their importance to priority FFMB species.

Vegetation Layers and Cover	Provide places to nest, material for nest building, cover from predators, sources of food (fruit, buds, insects, etc.)
Stand Age/ Tree Size	Different species prefer certain tree sizes/ ages, requiring larger or smaller trees for nesting or feeding
Standing Dead Trees	Insects in rotting or dead trees are a food source for many species; provide structures for good views for perching and singing, and good substrates for cavity excavation
Dead Woody Material	Insects in rotting wood on the forest floor are a source of food for many species; larger materials provide hiding places from predators and cover for ground nests
Deciduous Leaf Litter	Substrate for abundant insects for ground feeders; nesting material for Ovenbird
Native Biodiversity	Introductions of exotic plants reduce native biodiversity and can reduce native food sources. Pests and disease affect key tree species important to wildlife
Riparian and Wetland Forests	High concentrations of wildlife; travel corridors; can provide nucleus of large forest block

VEGETATION LAYERS
AND COVER

There are typically three vegetation layers defined within a forest stand: *understory* (1–6'), *midstory* (6–30'), and *overstory* (>30') (Fig. 9). *Vegetation layer cover* is the proportion of the forest floor covered by the vertical

projection of the tree and/or shrub *crowns* of any of these individual vegetation layers. A forest stand with full crowns in the trees over 30' tall would have high overstory cover but might have very low midstory cover if there are only a few trees with sparse crowns in the 6–30' range.

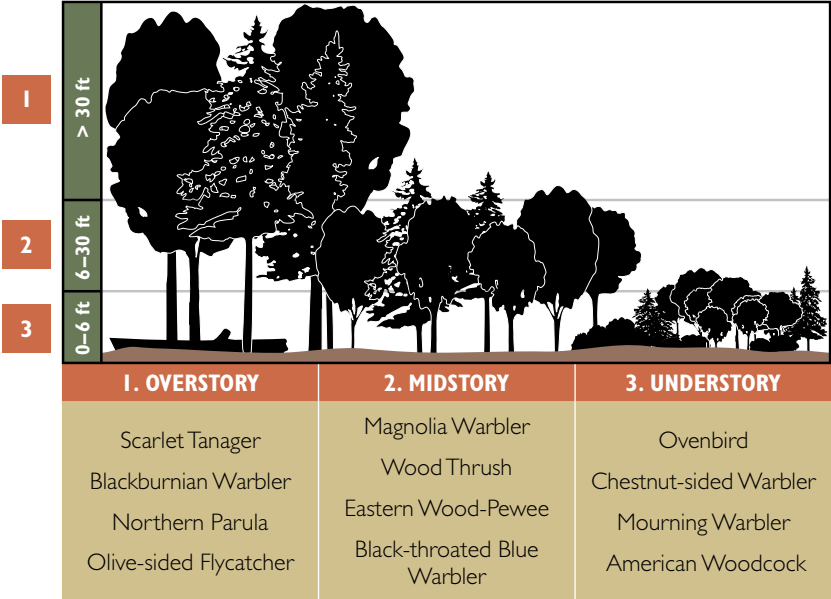


Figure 9. Illustration of three vegetation layers and examples of birds that use each.

Canopy cover is the proportion of the forest floor covered by the vertical projection of the overstory and midstory layers combined, or the cover of all vegetation more than six feet from the ground. This is the measure of canopy cover used in many forest bird studies

(sometimes called canopy closure) and reported for the individual bird species in this guidebook. It is also the measure estimated from viewing an aerial photo, in which the overstory and midstory layers are indistinguishable.



Figure 10. This recently cut small canopy gap in an Oak-Pine forest will develop a dense understory in the coming years, providing cover and food for many bird species.

Birds are attracted to the presence (or absence) of different vegetation layers as well as the amount of cover in each layer and in the overall canopy. Species such as Black-throated Green Warbler prefer forest stands with high canopy cover (>80%), where very little blue sky is visible through the combined overstory and midstory layers. Species such as Mourning Warbler use younger forest with lower canopy cover (<30%) but with higher understory cover (40–70%).

Another aspect of vegetation layers important to FFMB priority species is the presence of **canopy gaps**, openings one-quarter acre (roughly 100'x100') to two acres (roughly 300' x 300') in the overstory, or combined overstory and midstory (Fig. 10). Canopy gaps are important for species such as the Eastern Wood-Pewee and Olive-sided Flycatcher that fly through these gaps to catch insects on the wing. These small gaps occur naturally in older forests as a result of windthrow or disease. Several bird species of conservation concern that use these small natural gaps in the woods (such as Chestnut-sided Warbler) have adapted to using larger openings created by forest management.

STAND AGE, TREE SIZE AND STRUCTURAL COMPLEXITY

Although many bird species have preferences for smaller or larger trees, shorter or taller trees, the use of stand age to describe this aspect of bird habitat (and stand structure) can be confusing or misleading. Poor growing conditions can produce smaller trees in an older forest compared to trees growing under better conditions in a younger forest.

Birds don't know the age of a forest stand, but focus instead on the differences in structural complexity (including gaps) that generally come with the changing age of a forest. Most of the FFMB priority species use more structurally complex, generally older stands (Fig. 11), though several key in on the lack of structure that comes with young forest. Many are looking for a variety of tree sizes as well as a variety of vegetation layers (see previous section). Many are attracted to the presence

of larger trees that have a variety of places to nest and dead trees or snags with potential for nest cavity excavation.

This guidebook combines the concepts of stand age, tree size, and structural complexity (including the density of overstory, midstory, and understory layers) together into three broad **Forest Habitat Age Classes** (Young, Intermediate, and Older) (Table 8) that reflect general usage by birds and other wildlife. To more accurately address the habitat requirements of specific bird species, the Forest Habitat Age Classes are further divided into a total of six **Stand Structure Classes** ranging from the least complex structure and youngest class (seedling) to the most complex, oldest class (Older Complex/Large Sawtimber) (Table 8 and Fig. 13). These stand structure classes are consistent with classes typically used by foresters.

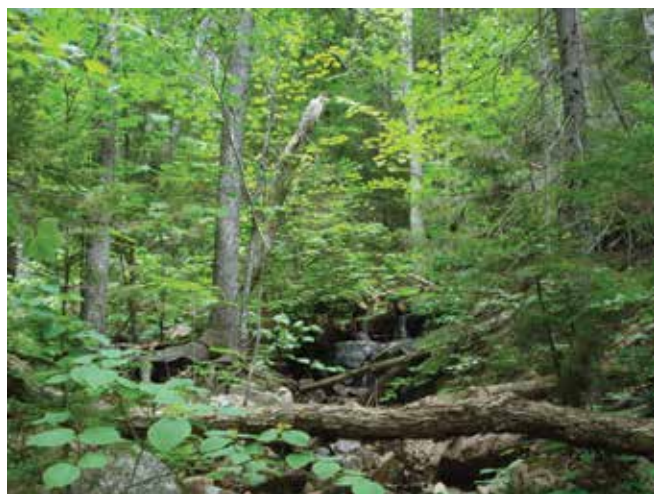


Figure 11.
An older
hardwood stand
(stand structure
class 5) with
high structural
and vegetative
diversity.



Figure 12. Spruce Grouse eat primarily pine and spruce needles, and stay in northern Maine’s coniferous forests throughout the year. They prefer areas with dense stems and high midstory cover of conifers.

Table 8. Stand Structure Class describes the general structure of a stand. FFMB species in general prefer more complex vertical and horizontal structure. FFMB promotes a mix of these classes across the landscape, with particular focus on older classes (4 and 5).

STAND STRUCTURE CLASS			
HABITAT AGE CLASS	#	CLASSIFICATION NAME	DETAILS
Young	1	Seedling	0–10 years, <1" DBH, >80% understory
	2	Sapling	10–25 years, 1–5" DBH, 10–30', >80% midstory, <30% overstory
Intermediate	3a	Single-aged Poletimber	20–70 years, 5–10" DBH, 30–70% overstory, <30% midstory
	3b	Two-aged Poletimber with Partial Overstory	Variable age, 5–10" DBH, 30–70% overstory, >30% midstory
Older	4	Maturing/Small Sawtimber	70–100 years, 10–16" DBH dominant trees, >70% canopy cover
	5	Older Complex/ Large Sawtimber	>100 years, >16" DBH dominant trees, >70% canopy cover; multiple layers common



I YOUNG — SEEDLING

Young stands prior to canopy closure.

Age 0–10 years

Dominant Tree DBH <1"

Vegetation Layers

Little or no canopy, dense understory >80%

2 YOUNG — SAPLING

Young stands with high midstory cover and low overstory cover.

Age 10–25 years

Dominant Tree DBH 1–5"

Vegetation

Layers >80% mid-story, <30% overstory, 10–30' tall



Figure 13. Examples of the three different habitat age classes and the six stand structure classes used by FFMB.



3A INTERMEDIATE — SINGLE-AGED POLETIMBER

Developing stands transitional between young forests and older forests—birds associated with both appear in this age class.

Age 20–70 years

Dominant Tree
DBH 5–10"

Vegetation

Layers 30–70% overstory, <30% midstory

3B INTERMEDIATE — TWO-AGED POLETIMBER WITH PARTIAL OVERSTORY

Two-storied stands resulting from partial harvesting or disturbance. Depending on overstory cover, may provide habitat for some young or older forest species.

Age Variable

Dominant Tree
DBH 5–10"

Vegetation

Layers 30–70% overstory, >30% midstory



A photograph of a forest stand with many young, slender trees. The canopy is relatively closed with green leaves. The ground is covered with fallen leaves and some low-lying vegetation.

4 OLDER — MATURING/SMALL SAWTIMBER

Generally closed-canopy forest. Most older forest bird species present, but some may be limited if structures such as large snags/cavity trees, canopy gaps, understory vegetation absent.

Age 70–100 years

**Dominant Tree
DBH** 10–16"

**Vegetation
Layers** >70% canopy
cover

A photograph of a forest stand featuring a large, mature tree with a thick, deeply furrowed trunk in the foreground. The forest floor is covered with ferns and other vegetation, and the background shows a dense canopy of trees.

5 OLDER — OLDER COMPLEX/LARGE SAWTIMBER

Complex structure with canopy gaps, multiple layers, large trees, snags, and downed logs. Preferred habitat for mature forest species.

Age >100 years

**Dominant Tree
DBH** >16"

**Vegetation
Layers** >70% canopy
cover, multiple vegetation
layers common

Figure 13 (Cont'd.) Habitat age and stand structure classes.

STANDING DEAD AND DYING WOOD

Snags are standing dead trees that are likely sites for current (or future) excavated or natural cavities. **Cavity trees** are live trees with natural or excavated cavities. **Decay trees** are live trees with **cull** sections suitable for cavity excavation, or diseased trees that are dying. Several FFMB species require cavity trees for feeding and nesting (Black-backed Woodpecker, Yellow-bellied Sapsucker, Northern Flicker, Boreal Chickadee), and many other wildlife species (including bats, flying

squirrels, wood ducks and small mammals) use the cavities as well. In general, snags over 9" DBH are most useful as cavity trees, though larger birds may need larger cavities with larger openings (Fig. 14). In addition to providing nest sites, snags, cavity trees, and decay trees are often riddled with bark- and wood-boring beetles, an important food source for forest woodpeckers. Once snags fall (see next section), they continue to provide wildlife habitat for many years into the future.



Figure 14. Pileated Woodpeckers, Maine's largest woodpeckers, strongly prefer larger snags (>16" DBH) for cavity excavation and nesting.



Figure 15. Ruffed Grouse attract mates in the spring by perching on downed logs and “drumming” their wings. Logs are typically >8" in diameter and more than 6.5' long.

DEAD WOODY MATERIAL

Coarse woody material (CWM) includes downed logs and branches >6" in diameter and more than 4' long. **Fine woody material** (FWM) includes smaller limbs and branches that are aggregated together on the ground into piles, including logging slash, fallen dying trees, or softwood tree tops left on the ground after logging operations. Both CWM and FWM (especially when aggregated into piles) provide

additional perching and feeding sites for birds such as Ovenbird and Winter Wren. Larger CWM (>8" diameter) are used by Ruffed Grouse as sites for male courtship displays (Fig. 15). CWM and FWM provide cover and feeding sites for small mammals, woodland salamanders, and insects and other arthropods that are a significant food source for many forest birds. Piles of CWM are important resting places for American marten in winter.

DECIDUOUS LEAF LITTER

An abundant layer of moist *leaf litter* is home to an array of insects, mites, and spiders. For birds such as Wood Thrush, Veery, and Ovenbird, these arthropods make up a significant component of their diet during the breeding season. Ovenbirds also need a deep layer of deciduous litter for constructing their ground nests (Fig. 16). The period from early May to late July is the best time to assess leaf litter conditions. For the purpose of FFMB management, deciduous leaf litter is only considered to be a habitat value in hardwood and hardwood-dominated mixedwood stands.

HABITAT CONCERNS



Emerging research shows that invasive earthworms can decimate leaf litter, exposing tree roots (see above). This is detrimental to bird habitat values, destroys habitat for spring wildflowers, and inhibits forest regeneration. All common earthworm species in Maine are non-native. Avoid storing manure or compost near hardwood stands into which worms could easily spread. For more information, see *Invasive Exotic Animals*, p. 61.



Figure 16. Ovenbirds need thick layers of deciduous leaf litter in order to build their “oven” nests on the forest floor.

NATIVE BIODIVERSITY

Introduced exotic species can have devastating impacts on native plants and animals. Invasive species grow and reproduce quickly, and spread aggressively, outcompeting native plants and animals, often depleting food sources and altering habitat.

Invasive Exotic Plants Several species of exotic shrubs found in Maine's forests can displace native understory plant species and prevent or severely limit the regeneration of trees, thereby affecting the long-term composition and integrity of the forest (Fig. 17). The most problematic invasive species in Maine now include three honeysuckles, two buckthorn species, Japanese barberry, Japanese knotweed, and Asiatic bittersweet (See Appendix C, p.114).

Some invasive plants have persistent fruits that may benefit birds looking for new food sources; however, if short-distance migrants stay behind because of this novel food source, their movement might be adversely affected. Conflicting results from studies about the nutritional value of invasive species' fruits raise questions about how they might affect bird health. One of the most detrimental invasives now gaining a foothold in Maine, Glossy Buckhthorn, has been shown to contain emodin, a natural laxative that prevents mammals from digesting sugars.

A larger issue for birds is the lack of insect and invertebrate communities around invasive exotic plants. Studies have shown that habitats supporting a diversity of native plant species are more likely to support a diversity of



Figure 17. A carpet of invasive Japanese Barberry covers the forest floor, crowding out native species and reducing the possibility of regeneration.

insect species. The relationship between plants and the animals that use them for food and shelter is complex, but even with the potential benefits some invasive plant species might provide for birds, the overall reduction in native plant and animal diversity that results from aggressive invasive species infestations reduces overall bird habitat quality.

Invasive Exotic Animals

Invasive insects threaten birds and other wildlife by killing trees that provide important habitat. Hemlock woolly adelgid is one of the species of greatest concern, as this species kills hemlocks that are essential to Black-throated Green Warblers, Blackburnian Warblers, and other birds in southern Maine where other conifers such as red spruce are lacking. Asian longhorned beetles have been found as close as Massachusetts, and eradication efforts have included cutting more than 60,000 trees in the northeast thought to be infested with larvae (Fig. 18). Winter moth, gypsy moth and other invasive insects may cause periodic, more localized problems. Emerald ash borer has reached New Hampshire and will likely reach Maine in the coming years. It has caused widespread death of ash in other states to the south and west.

All earthworms in Maine are exotic, and research has shown that they can cause significant damage to deciduous forests. When they spread through forests, they consume the leaf litter and humus layer, resulting in bare soil and the elimination of plants and

WHAT ABOUT SPRUCE BUDWORM?



Although timber product values may suffer from spruce budworm, many bird species benefit from budworm outbreaks. Spruce budworm is a native insect that cycles naturally in association with maturing balsam fir. Birds such as Bay-breasted, Tennessee, and Cape May Warblers eat spruce budworm caterpillars, and their populations can explode during spruce budworm outbreaks, even as trees suffer high levels of mortality.

wildlife associated with the forest floor. Forest regeneration may also be adversely impacted. However, little research has been done to date on their impact in Maine.



Figure 18. Pair of Asian Longhorned Beetles, with female chewing an egg laying site in a maple tree.

For more information on invasive forest species

and how to control them, visit the Maine Natural Areas Program website (www.maine.gov/dacf/mnap) or email invasives.mnap@maine.gov. You can also find more information at the Maine Forest Service website (www.maineforestservice.gov), and in Appendix C.

RIPARIAN AND WETLAND FORESTS

Riparian and wetland forests contain or are adjacent to seasonal or permanent standing water including small pools, seeps, intermittent and perennial streams, rivers, ponds, lakes, and coastal


waters. Forest types may include wetland and floodplain communities as well as upland forest ecosystems that border rivers, streams, and lakes.

These forests support an unusually high concentration of wildlife and are essential to FFMB spe-



cies such as Canada Warbler and Veery that prefer wet areas. Forested wetlands are critical habitat for many other forest birds such as Northern Waterthrush and Rusty Blackbird, as well as tree-nesting waterfowl (Wood Duck, Common Goldeneye, Hooded Merganser, Common Merganser) and large raptors (Bald Eagle, Osprey) that use large trees in these forests as perching and nesting sites. Both aquatic and semi-aquatic animals

such as beaver, otter, and mink use this forest type. Upland mammals such as deer, bobcat, coyote, moose and bats frequently use riparian and wetland forests for denning, traveling, and feeding. In southern Maine's developing landscape, wetland and riparian forests often form the nucleus of large forest blocks and provide a network of travel corridors that are critical to many species.



Up to 80% of Maine's vertebrate wildlife species use riparian habitat during some or all of their life cycle.

LANDSCAPE CONTEXT

Understanding how habitat features described in the preceding section are arranged across the landscape, both within an ownership and across property boundaries, is critically important for FFMB. Landscape context is important on both small and large ownerships. Even though small landowners cannot control what happens beyond their property boundaries, considering the landscape around a property provides important information about the species likely to be present and informs options for management that can enhance habitat values. In addition, a landscape view may allow multiple owners in an area to work together toward FFMB management goals across space and/or time, or may help identify habitat conditions most desirable to manage for on any given ownership.

Large forestland owners often have the ability to manage habitats for most wildlife species across the full range of forest age classes and habitat types. Managing forests “with birds in mind” should include a look at the landscape context surrounding any given area. Two elements to consider include:

Size and Shape The size and shape of a forest block matters to many bird species (Fig. 19). A long, thin block of forest has less interior and more edge compared to a square block, and many bird species are sensitive to these features. Birds such as Wood Thrush, Scarlet Tanager, and Ovenbird prefer forest interiors and avoid edges. Microclimate elements, including temperature and moisture, can change along a forest edge. Forest edges can also be an entry point for predators and parasitic cowbirds, especially near agricultural areas. Forest edges are more prone to invasive species, higher predation rates, and reduced habitat quality. As a result, birds may need to maintain larger territories in order to survive and find enough food. Some birds simply require larger forest blocks, regardless of shape, to do well. The home range size for these area-sensitive birds increases as forest blocks become smaller.

Distribution of Habitat Age Classes Maintaining different ages of forest across the landscape is important for providing a broad array of habitat for all wildlife species. Historically, Maine’s forests were heavily dominated by older forest, with smaller patches of younger stands growing as a result of natural disturbances such as wind, hurricanes, pests, or disease, which killed or toppled individual or small groups of trees over space and time.

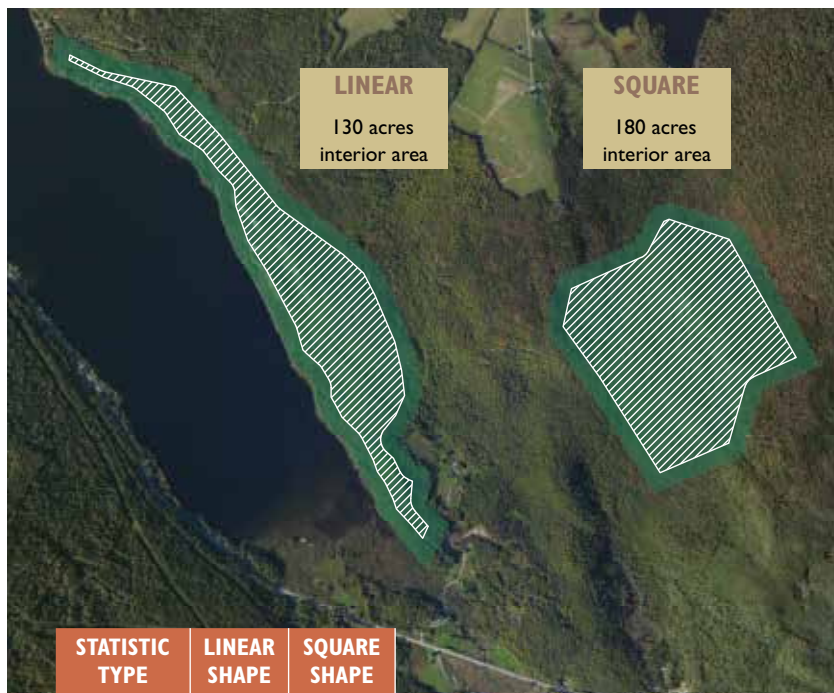


Figure 19. The shape of a forest block can dramatically change its habitat value. Blocks that are longer and skinnier will have less interior forest compared to blocks that are square. Many of the FFMB priority species prefer interior forests. They will use forests with more edge but will typically not be as successful.

A principal goal of FFMB is to promote forests with strong structural and age class diversity that mimic natural disturbances and the structural features they create.

IV. Forestry for Maine Birds Habitat Assessment

OVERVIEW

This section includes three simple qualitative assessments to evaluate habitat features important to forest birds.

- 1. The Stand Assessment** documents forest conditions at multiple points within a stand, or summarizes forest conditions across a stand.
- 2. The Property Assessment** combines multiple stand assessments to provide an overview of conditions across a property.
- 3. The Landscape Assessment** evaluates the conditions on a broader scale to place a landowner's stand in context within the surrounding forest conditions and habitat. For larger landowners, the landscape and property assessments may overlap.

These assessments can be used together to develop specific management recommendations. The final

section of this guidebook (Section V, *Managing Forests with Birds in Mind*, p. 76) ties assessments to forest management options that create or enhance habitat for priority bird species.

I. STAND ASSESSMENT

The *Stand Assessment Data Form* (Appendix D) is the basic tool for gathering forest bird habitat information at the stand level. Much of the information is typically collected as part of a standard forest inventory or cruise. Foresters can adapt the data form to fit existing inventory systems, with the collection of FFMB information adding only a few minutes to standard field inventories.

There are two versions of the data form included in this guidebook (Appendix D). Both are also available online at the FFMB website (maineaudubon.org/FFMB). The long version (p. 116) contains explanations for each field, and is used at FFMB workshops (Fig. 20). The short version (p. 122) omits detailed guidance and will likely be the preferred option once a forester becomes familiar with the assessment method. Either form can be modified for a forester's needs. The assessment data form uses qualitative, science-based measures of habitat features that are associated with known habitat preferences of different bird species. No special tools are required, and there is no fixed plot size.

WORKING WITH EXISTING FOREST TYPE DATA AND CLASSIFICATION SYSTEMS

Large forest landowners typically have detailed cover type maps and classification systems in place. Many foresters also use their own individualized forest classification systems.

FFMB forest habitat associations and stand structure classes can be integrated into those existing systems, or managers can develop crosswalks connecting existing stand inventory and type data with FFMB associations and classes.



Figure 20. Foresters at an FFMB workshop assessing a forest gap.

Inventory Point Method

One option for foresters is to complete the *Stand Assessment Data Form* at each point (or every second or third point) at which forest inventory data are gathered. This approach provides the greatest insight into variations within and across stands and allows management recommendations to be tailored to that variability. Additional measures for FFMB habitat features should not take a significant amount of time over standard inventory data collection.

Stand-Level Method Another option is to use one *Stand Assessment Data Form* as a summary of the stand conditions. This can be completed quickly after a typical forest inventory or after walking through a forest stand, using the form to describe the general condition of the habitat features.

At the simplest level, it is also possible to evaluate the stand based on forest type and stand structure class information. These data may be obtained from a good stand-scale forest inventory or detailed cover type maps.

ASSESSMENT DATA FORM

This section gives an overview of the assessment data form (Appendix D). Data can be collected for a standard inventory area, or for the “visual acre” around a plot center. Electronic copies of the assessment forms can be found at maineaudubon.org/FFMB

Stand ID An identification number or other designation for the stand, determined by the forester’s conventional system.

Plot ID or GPS An identification number for the plot within the stand and/or GPS point from which data is being collected.

Forest Habitat Association and Type (*p. 39*) Forest Habitat Association and Type for stand and/or area of assessment. Some birds have strong preferences for some forest habitat associations over others.

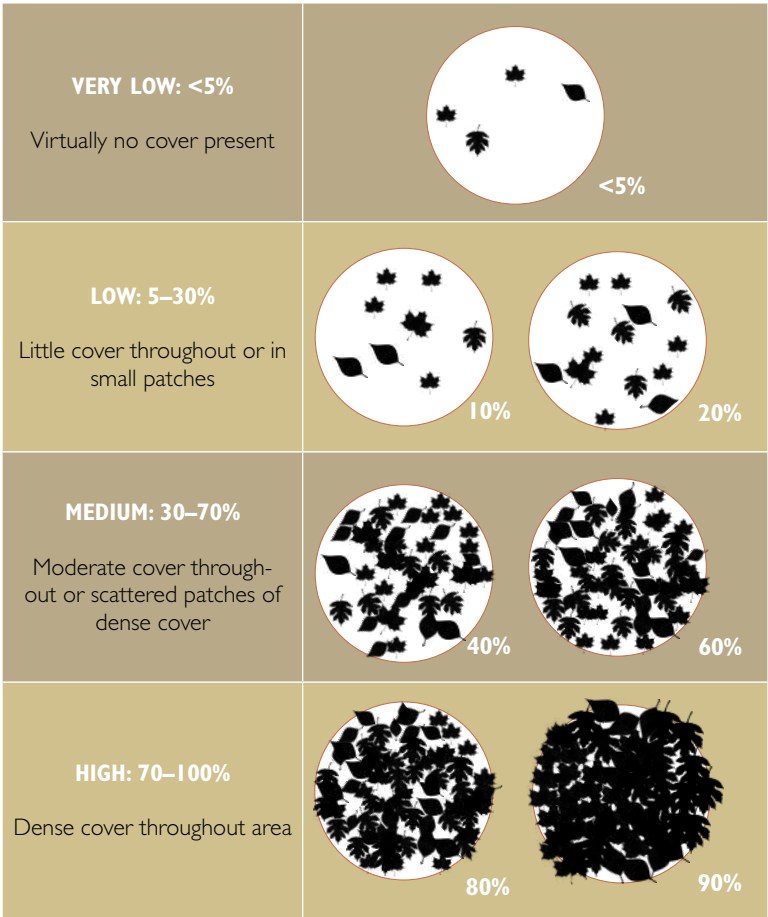


Figure 21. Visualization of layers to help estimate FFMB vegetation layer covers.

Stand Structure Class (*p. 53*)

The six Stand Structure Classes describe the general structure of a stand and are divided into three general Forest Habitat Age Classes.

Vegetation Layers (*p. 50*) For overstory (>30'), midstory (6'-30'), understory (0-6'), canopy, and ground layer cover, use one of the four broad categories (very low, low, medium, or high) (Fig. 21) to describe the area around the inventory area (if conducting multiple assessments within a stand) or throughout the stand (if making only one summary assessment). For each layer in question, the measure of cover is the vertical projection of how much of the ground is covered by leaves (or conversely, how much of the sky is obscured by leaves when a person looks up through that particular layer). Skid trails and openings may reduce cover depending on their size. New clearcuts may only have an understory layer. These measures match what is commonly used by forest managers, though they can easily be adapted to other systems that are more detailed or use densiometers or other measurement tools to more quantitatively assess cover or closure.

Dominant Species List tree species in order of relative dominance for overstory, midstory and understory layers. In hardwoods, be sure to note softwood inclusions, even if only a minor component.

Composition Estimate the percentage of Hardwood (H) and Softwood (S) around the area for overstory and midstory layers.

Canopy Height Estimate the height range of dominant and co-dominant trees in the overstory, either 30–60' or greater than 60' tall.

Gaps Present? (*p. 51*) If there are gaps in the overstory, estimate how many per acre, or the percent of the stand taken up by gaps. An estimate of the average size of gaps is also helpful if gaps are uniformly sized. If gaps vary widely, describe or list range of sizes.

Snags/Cavity/Decay Trees (*p. 57*) Count the number of dead/dying/cavity >6' tall trees in the following categories: small (<9" DBH), medium (9-12" DBH), large (12-18" DBH), and very large (>18" DBH). Count all the visible trees in this category, walking around the inventory area if needed to see into low points or behind obstructions.

Coarse Woody Material (CWM) (*p. 58*) Count the number of logs or large branches on the forest floor that are >6" diameter and >4' in length or standing and <6' tall. Categories are high (>20 pieces), medium (6–20 pieces), and low (<6 pieces) (Table 9).

Fine Woody Material (FWM) (*p. 58*) Count the number of piles/aggregates of small branches/tops/slash. Scattered fine woody material should not be counted. Categories are high (>5 piles), medium (1-4 piles), low (no piles) (Table 9).

Table 9. Measures of woody material within visual range around an assessment point.

MEASURE	DESCRIPTION	CWM	FWM
High	Abundant throughout the stand Difficult to walk in places	>20 pieces	>5 piles
Medium	Scattered throughout the stand Occasionally need to step over pieces	6–20 pieces	1–4 piles
Low	Few or no pieces Easy walking throughout the stand	<6 pieces	None

Leaf Litter (*p. 59*) Estimate the average leaf litter layer thickness. Categories are adequate (>1.5" thick during spring and summer), not adequate (<1.5" thick during spring and summer) or not applicable (softwood stands).

Invasive Plants (*p. 60*) Record the species present in the inventory area, and estimate the percent cover. Also note any invasive plants encountered on the way to other points, or at other locations within the stand.

Insects and Disease (*p. 61*) Note any signs of insects or disease either at the inventory point, on the way to other points, or in other locations within the stand.

Riparian and Forested Wetland (*p. 62*) Note the presence of any forested wetlands or forested riparian areas either in the inventory area, on the way to other points, or in other locations within the stand.

Stand Summary Field assessment data should be summarized within a stand and included in the management plan. One approach is to develop a narrative about key features observed in each stand; another is completing a summary assessment that captures data from multiple points. Whatever the method, the goal is to capture the general characteristics in terms of habitat values for priority bird species. The stand summary provides the landowner with information about the habitat features encountered, and should help a landowner understand how management recommendations might create or enhance habitat values for bird species. On larger ownerships for which a stand description may be generalized to cover thousands of acres of similar forest type, stand assessments might reference the typical structures found in the stand type and their value to forest birds. The approach will depend upon the size of the ownership and the characteristics of the surrounding landscape.

2. PROPERTY ASSESSMENT

Most properties are made up of multiple stands with different tree species, ages, and/or conditions. Summarizing stand assessments across a property will help determine effective FFMB management strategies for providing quality bird habitat across both time and space. Suggestions for ways to summarize property information include:

Property Summary Two tables can help summarize habitat associations and stand structure classes across the property in a way that facilitates decisions about management plans and desired future conditions. First, the Management Plan Table (Appendix E, p. 124) should include, at a minimum, the Forest Habitat Association, Stand Structure Class, and acreage for each stand on the property. Second, the Forest Habitat Association Table (Appendix E, p. 125) simply consolidates data from this first table in a way that highlights Stand Structure Classes and Habitat Associations across the entire property. Working between these two tables, foresters and landowners can review how much of each Stand Structure Class is on the property, and where (and what types of) forest management activities might be prioritized for both short- and long-term habitat benefits.

SMALL VS. LARGE OWNERSHIPS

For the purposes of FFMB management, this guidebook uses a general threshold of 2,500 acres to distinguish between small and large ownerships.

FFMB management applies to any size ownership, from small woodlots with one or a few stands to large multi-township ownerships more typical of northern Maine. The assessment tools in this section are useful for any size property, though how those are applied may differ.

Smaller ownerships will typically have a more refined scale for stand level assessment. At this scale, the landscape context will be valuable for planning and for understanding potential impacts to forest bird habitat.

Larger ownerships may delineate larger stands and frequently have a coarser scale for any stand-level assessment. Landscape and property-level planning may be identical for large landowners, and large landowners may have a greater opportunity to positively shape the landscape from the birds' perspective.

An Excel file with templates for these tables is available at the FFMB website (maineaudubon.org/FFMB). When totals are filled in the Management Plan tab, the totals on the Forest Habitat Association tab and associated graphs/figures will be automatically generated.

Property Map Create a map of the property with delineated stands and descriptors that align with the table described above, or with similar information from other cover typing systems. See Landscape Analysis sidebar (p. 72) for sources of online aerial photography images.

3. LANDSCAPE ASSESSMENT

Although stands are the functional units foresters use to manage a woodlot or a larger forest, birds don't necessarily recognize stand boundaries and may use multiple stands for nesting, breeding, or feeding. As discussed at the end of Section III, the characteristics of the landscape surrounding any individual forest stand can greatly influence species such as the Ovenbird (Fig. 22) that are sensitive to landscape forest composition. Several online tools can help assess current forest conditions in the landscape surrounding a stand (see pp. 74–75 and below) and create a big-picture perspective for implementing appropriate bird habitat management efforts over space and time.

Defining Landscape Assessment Units On smaller ownerships, landscape assessment units should include an area at least 2,500 acres around the property and can go up to as

large as 10,000 acres if desired. For larger ownerships, landscape units should be 5,000 acres or more based on features that can be readily mapped (e.g. roads, watersheds, township boundaries, etc.). On very large ownerships in the unorganized towns, the township (roughly 23,000 acres) may be an appropriate landscape assessment unit.

The Landscape Context Assessment (Appendix F, p. 126, and also available online at maineaudubon.org/FFMB) focuses on three important features of productive landscape habitat that influence the abundance of FFMB priority species.

Overall Cover Estimate how much forest is in the area around a property. For larger ownerships, in a generally forested landscape, the percent of forest cover may be less relevant to future management of forest birds than is the balance of age/structure classes. However, in more developed areas of the state, and where forests may be managed

A Sample of Landscape Analysis Tools

Sites such as mapquest.com or maps.google.com have basic aerial photos for most regions of the state.

Google Earth (earth.google.com) has powerful capabilities to review multiple geographic layers for landscape analysis, including the latest National Land Cover Dataset (NLCD2011) (see pp. 74–75).

The Maine Office of GIS (www.maine.gov/megis/maps) has links to a Beginning with Habitat map viewer, with which you can search towns or regions for specific features, and also download many town-specific maps in PDF form.

within an urban or agricultural setting, the percent of forest cover in the area surrounding a stand or property will be critical to the integrity of forest bird habitat. List types of features that are in the landscape (agriculture, housing/yards, industrial, etc.) in the comment section.

Stand Structure Class Estimate the amount of older and younger forest surrounding a stand. This may be largely qualitative, as it can be difficult to glean reliable habitat age class information from most aerial imagery. However, recently cut or early successional stands may be more apparent in aerial photos, and young, uniform stands may be easier to delineate if the forester is familiar with the general area. The best estimate of the age of the surrounding forest is based on familiarity with the area

and aerial views from the internet or other sources (pp. 74–75, and side bar p. 72).

Forest Block Size Estimate the size of the forest block or blocks surrounding the stand. A forest block is an area of contiguous forest that is not divided by major roads and non-forest habitats. A forest block may include smaller roads with narrow canopy gaps (<30' from driveways or skid roads), but larger roads (two lanes, wide shoulders) and non-forest habitat such as developed areas and agricultural fields are fragmenting features. Some online GIS programs have tools to measure area, but for FFMB management, estimating area from aerial images (and local knowledge of landscape) is adequate to estimate block size.



Figure 22. Species like the Ovenbird are influenced by landscape-level forest features.

Landscapes Over Time Because forests are always changing, one snapshot is not always enough to tell the whole story. In Google Earth Pro, there is a feature that allows you to “travel back in time” and view aerial photos from different years and different seasons.

Following a time series like the one below (for a 2,500 acre area of land around a property) can help reconstruct land use history and subsequent forest age and condition in the landscape around a property.

APRIL 20, 2006

Photo taken before leaf out so brown areas are likely hardwood forest, and dark green areas softwoods. Based on visible old skid roads, there is some evidence of past harvesting.





APRIL 27, 2012

Another photo taken before leaf out reveals denser conifers as a result of growth over the past six years. A small wetland is evident among the softwood stand on the left side of the circle.



SEPTEMBER 18, 2013

This photo reveals some new harvested areas. Because it's a fall photo taken before leaves have fallen, the density of foliage of hardwood trees is evident.

V. Managing Forests with Birds in Mind

Managing forests with birds in mind is compatible with many other management goals and objectives on any size property, from small family woodlots to large commercial timberlands. After reading about the priority birds (Section II) and the forest habitat features they need (Section III), then assessing stand, property, and landscape features (Section IV), the final step

is making management recommendations. FFMB management recommendations should create and enhance forest habitat and support birds of conservation concern as well as other wildlife, both now and into the future.

This final guidebook section provides an overview of how to put all the various FFMB pieces together to inform management strategies and decisions.

A “TRAIL MAP” FOR FFMB MANAGEMENT AND PLANNING



LANDOWNER GOALS AND OBJECTIVES

What FFMB species or habitats interest the landowner?

What are other landowner goals?

Develop objectives for desired future habitat conditions that will meet landowner goals, highlighting those that align with the FFMB approach.

FFMB Sections II and III

CURRENT HABITAT CONDITIONS

What are the current FFMB habitat features across a stand, property and landscape?

Use the FFMB Stand, Property and Landscape Assessments to document and summarize current habitat conditions

FFMB Section IV



GOALS AND OBJECTIVES IN LIGHT OF CURRENT HABITAT CONDITIONS

Are goals and objectives realistic based on assessments?

Refine objectives as needed so they are achievable with current habitat conditions and silvicultural options, incorporating the FFMB goals for different forest ages, and the landscape context for the property or stand, including forest block sizes.

FFMB Sections II - IV

SILVICULTURAL SYSTEMS

How can FFMB enhance silvicultural prescriptions?

Consider the pros and cons for FFMB species of different silvicultural approaches.

Integrate FFMB forest structure and other habitat elements into silvicultural prescriptions and operations plans.

FFMB Section V

FOREST MANAGEMENT PLANS

How can the FFMB approach be incorporated across the ownership?

Work with landowner to create a management plan that highlights the connections between forest structures and bird habitat, as well as the benefits of active management to create desired future habitat conditions. Include copies of bird species pages for those species likely to benefit from management recommendations.

FFMB Section V

SILVICULTURAL SYSTEMS AND FOREST BIRD MANAGEMENT

The habitat features used by FFMB priority species can be created or enhanced through forest management. Foresters practice silviculture, the art and science of growing trees and managing forests, at the stand scale by determining which trees to grow and which to remove. Silvicultural systems can generally be divided into multi-aged (uneven-aged) and even-aged systems.

MULTI-AGED (UNEVEN-AGED) SILVICULTURAL SYSTEMS

A multi-aged silvicultural system fosters three or more age classes of trees in the same general area or stand (Fig. 23). The different aged trees can be arranged in a vertical layered structure, with younger trees

growing beneath older trees, or as spatially distinct age groups spread across the stand. This diversity of canopy levels and densities promotes habitat used by many FFMB priority bird species. Special attention must be paid to the establishment and recruitment of understories to ensure desirable habitats result from multi-age management.

Examples of Multi-Age systems include:

- **Single Tree Selection** Results in well-stocked understories and mid-stories, providing ideal nesting and feeding habitat for many bird species. Overstories typically moderate or even low where trees are removed in order to enable upward recruitment



Figure 23. Multi-aged systems create three or more age classes of trees and promote diverse bird habitat.

Because multi-aged systems generally maintain a relatively continuous forest canopy and robust mid- and understory vegetation layers, they are especially well-suited for managing older-forest habitat. Forest habitat for some young forest species can be provided by creating gaps (<2 acres) within a multi-aged stand.

of lower canopy stems into the future overstory. The presence of three canopy levels, uniformly distributed throughout the stand, provide diverse habitat for numerous species. Applicable to either hardwood or softwood stands, but most commonly applied in northern hardwoods.

- **Group Selection** Similar to Single Tree Selection but offers the chance to create a range of canopy levels and densities. Openings are in the range of 1/10 to two acres, but are typically less than one acre. The lack of uniformity in the distribution of these conditions likely presents a challenge to the forester but not the birds seeking the diverse habitat

conditions found in such stands. This system is well-suited to hardwood stands where either shade tolerant or intolerant hardwoods are desired.

- **Irregular Shelterwood** Relies on the shelterwood concept to promote regeneration of shade tolerant species under partial shade. Variants of this system create similar habitat for many FFMB species by promoting both horizontal and vertical diversity within all canopy levels. While applicable for both hardwoods and softwoods, the system is especially well suited to maintaining softwood species in mixedwood stand types, which has important habitat benefits for certain bird species (Fig. 24).



Figure 24. Two stories of softwoods in an irregular shelterwood system.

EVEN-AGED SILVICULTURAL SYSTEMS

In contrast to multi-aged systems, even-aged silvicultural systems develop a single age class of trees across an entire stand (Fig. 25). Under some types of even-aged management, a two-storied stand condition may persist for significant periods of the rotation. Even-aged systems initially promote young forest habitat, which is important for several FFMB species. Typically even-aged stands lose their bird habitat value as they age, so planning for changing habitats over time should guide the use of this method at the stand and property level.

Examples of Even-Aged systems include:

- **Clearcutting** Clearcutting promotes the development of young forest conditions that will serve as valuable bird habitat for a limited number of early successional species up to 20 years. This system is well suited to promoting intolerant hardwood species such as aspen and birch as well as many other hardwood species.
- **Seed Tree** Similar to clear cutting, seed tree systems promote young forest conditions over time, with the potential for long-term retention of seed trees to promote canopy level diversity. As with all even-aged systems, consideration of long-term habitat conditions at the landscape scale is important. This system is commonly applied in both hardwood and softwood stands including those dominated by oak, pine, or birch species.
- **Shelterwood** (including variants, such as extended shelterwood and shelterwood with retention) The shelterwood system includes many variants, all of which share the common characteristic of promoting two-storied stands where dense understories are established beneath partial overstory canopies (Fig. 26). This layered condition shares many of the habitat values found in multi-aged systems including dense understories with diverse midstory and overstory canopies. The differences between these systems emerge over time, depending on the variant used, as the overstory is completely or partially removed to release the understory stems. The blending of even-aged conditions with those of greater horizontal and vertical diversity in this system provide a greater diversity of desirable forest bird habitat conditions compared to other even-aged systems.

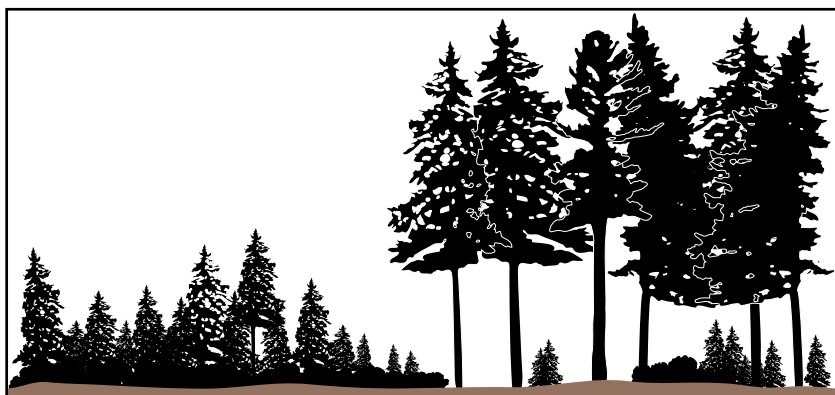


Figure 25. Even-aged systems develop single age classes of trees, and can initially benefit young forest species.

Where even-aged management dominates, plan for a mosaic of different ages and stand structure classes over time, with an eye to the FFMB landscape goals for older forest habitat. Even-aged systems are often preferred for the creation of young forest habitat, but modifications such as the retention of live trees — either scattered or clumped — and of other forest structures will help promote habitat diversity within a generally even-aged stand.

To maintain quality bird habitat with diverse physical structures across multiple stands, consider increasing the relative proportion of multi-aged versus even-aged management.

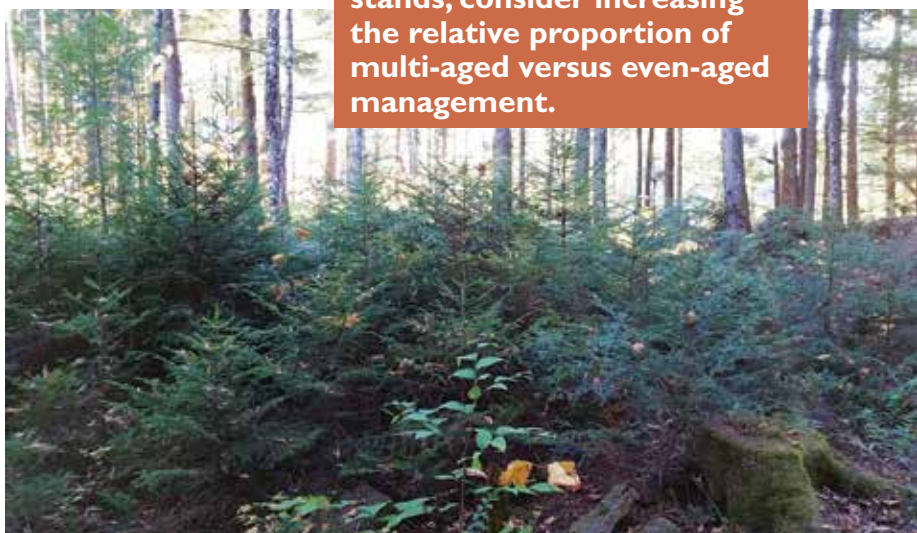


Figure 26. Regenerating softwoods in a shelterwood system.

FOREST MANAGEMENT PLANNING ACROSS THE LANDSCAPE

Starting big, with an overview of a property and its landscape context is critical to forest management “with birds in mind” (Fig. 27).”The development of a long-term, property-wide plan should begin with an assessment of the property and its landscape

context, as discussed in Section IV. This helps foresters and other land managers decide how and when to best manage specific stands for forest bird habitat. As with any management plan, FFMB planning decisions must reflect landowner goals and objectives.

YOUNG FOREST HABITAT

Young forests provide habitat for many species, including FFMB priority birds such as American Woodcock, Chestnut-sided Warbler, and Mourning Warbler. Several studies have found juveniles of other FFMB species commonly associated with older, mature forest (Wood Thrush, Scarlet Tanager, Ovenbird) using regenerating even-aged stands in the weeks after they have fledged. Interestingly, shrubland specialists such as Golden-winged warbler have also been documented in mature forests as juveniles, indicating that young birds may be more flexible than their parents in their ability to use a variety of available habitats. See references for management guidance on early successional and young forest habitat in Appendix G.



A healthy and diverse bird community needs a mosaic of stand structure classes across the landscape. Opinions differ about how much of that landscape should be older versus younger forest.

Acreage of young forest in southern Maine has decreased in recent decades, and there have been efforts to encourage the creation of more young forest in this region. The opposite is true in northern Maine, where there has been an increase in the percent of young forest on the landscape. Regardless of these differences, both regions have seen dramatic losses of older, more mature forest (Fig. 6, p. 12).

There are many excellent references for managing young forest habitat (see Appendix G, p. 127). Young forest conditions can be created relatively quickly, sometimes with almost immediate habitat benefits to birds and other wildlife. Fewer references exist for maintaining and enhancing the complex horizontal and vertical physical structure associated with



Figure 27. A mix of younger and older forest across the landscape is essential, though the FFMB approach emphasizes the need for more old-forest structure across the landscape.

older, more mature forest habitat. This can take decades, and on ownerships for which timber management is a priority, it will involve considerable planning and effort.

The need for management guidance for birds that use older forests is becoming more critical in regions where this habitat is declining. To help address this need, the FFMB approach emphasizes the restoration and/or enhancement of older forest, or “old-forest-like” structures on the landscape. Incorporating smaller patches of young forest within this older-forest matrix can play an important role in addressing habitat needs of early-successional forest birds.

Older Forest Goals FFMB management guidelines recommend maintaining a minimum of 40–50% of the landscape in FFMB Structure Class 4 and at least another 10% in FFMB Structure Class 5 (Table 10). These targets are similar to those in DeGraaf et al. (2007), which recommends a general target of 40–50% of the landscape in small sawtimber stands, and up to 10% in large sawtimber stands.

Young Forest Goals The need for additional young forest varies greatly by region and is influenced by ownership objectives. FFMB management guidelines recommend that 10–20% of the landscape be in young forest

Table 10. Summary of FFMB Landscape Goals for Habitat Age and Structure Classes in the 2,500-10,000 acres around the property.

HABITAT AGE CLASS	YOUNG	
% Landscape	10–20%	
Stand Structure Class:	1 — Seedling	2 — Sapling
Dominant Tree DBH*	<1"	1–4"
Age (years)*	<10	10–25
HABITAT AGE CLASS	INTERMEDIATE	
% Landscape	20–40%	
Stand Structure Class:	3a — Single-aged Poletimber	3b — Two-aged with Partial Overstory
Dominant Tree DBH*	5–10"	5–10"
Age (years)*	20–70	Variable
HABITAT AGE CLASS	OLDER	
% Landscape	40–50%	>10%
Stand Structure Class:	4 — Maturing, Small Sawtimber	5 — Old-Complex, Large Sawtimber
Dominant Tree DBH*	10–16"	>16"
Age (years)*	70–100+	>100

* varies by site and species

habitat (FFMB Structure Class 1 and 2, Table 10). Land managers should consider landowner objectives, target goals for older forest described above, and landscape context considerations described below before deciding how much young forest to create or retain through management. If young forest is a priority, consider the size and arrangement of young forest

blocks. Consolidating young forest into fewer larger blocks may leave bigger blocks of unfragmented older forest, which benefits interior forest birds (Fig. 28). Alternatively, depending on the landscape context, small patches of young forest within older forest will provide habitat for birds looking for forest gaps.

A BIRD'S EYE VIEW OF SMALL VS. LARGE OWNERSHIPS

Ownership size determines the type and amount of bird habitat a landowner can provide, as well as the degree to which surrounding ownerships influence habitat conditions:

On all size ownerships

Evaluate property-wide habitat conditions and landscape assessment data prior to making silvicultural decisions for individual stands. Use the Property Assessment (p. 71) to evaluate the balance of forest age classes and stand types on the property.

On small ownerships

Existing land use and management on surrounding properties has a significant effect on habitat values within the property. Even a small woodlot—less than 10 acres—can have greater wildlife habitat value if it is part of a larger forest block. Management activities on properties of this size can benefit wildlife that inhabit surrounding lands as well.

On large ownerships

Land managers can provide a full spectrum of habitat conditions for priority forest birds because the landscape context overlaps with property ownership. Land managers can evaluate how habitat conditions will change over time across the landscape or property based on forest management schedules and inventory data.

FFMB SIZE AND SCALE

Small Ownerships

<2,500 acres

Large Ownerships

>2,500 acres

Large Forest Block

>250 acres

Landscape

Includes a minimum of 2,500 acres, and up to 10,000 acres around small ownerships.

On larger ownerships, a typical township (roughly 23,000 acres) may be a more appropriate landscape management scale.



Figure 28. Wood Thrush are more productive, fledging more young within larger blocks of unfragmented older forests.

FOREST BLOCK SIZE AND SHAPE

How a property or a stand fits into the surrounding forest is another important landscape consideration for FFMB management (Fig. 29). Several FFMB priority species are associated with larger blocks of mature forest. Designing management strategies that retain or create larger blocks of forest (>250 acres) in the intermediate to older structural stages provides habitat for interior forest birds. That forest can be broken up by some smaller patches of young forest used by young forest specialists; however, larger clearings (>2 acres) may begin to fragment the block. Even though they may only be temporary, large or overly-abundant openings may drive interior birds away or reduce their productivity. Below are some considerations for managing forest blocks.

■ **PLAN** harvest units to promote and maintain moderate to large forest blocks (>250 acres) dominated by intermediate and especially older forest (FFMB Stand Structure Classes 3, 4, and 5).

■ **PLAN** even-aged regeneration harvests so they minimize fragmentation of existing large blocks of intermediate and older forest.

- Place cuts along the edges of forest blocks rather than scattered throughout the block.
- Consolidate even-aged regeneration harvests spatially when possible (e.g. with larger harvest blocks or multiple adjacent cuts over a 10-30 year time frame) to create areas that will develop into large blocks of interior-forest habitat in the future.

■ If young or intermediate-age stands predominate within a block, **MANAGE** for an increase in the percentage of older stands over time. Manage for more vertical and horizontal structure to make them look and feel like older stands.

■ **CONNECT** forest blocks by maintaining or creating forested travel corridors that increase habitat connectivity.

■ Small or narrow patches of intermediate and older-forest habitat, such as those in the minimum protection zones for small and mid-sized streams or regulated clearcut separation zones, do not provide high-quality habitat for species that require interior-forest conditions. **WIDEN** these zones to reduce the relative amount of edge habitat and increase forest block size. Consider managing areas adjacent to these zones as larger blocks of interior forest.

LANDSCAPE CONTEXT

The following section includes examples of management considerations and recommendations for several frequently encountered landscape context scenarios. The approaches described in this section can be adapted to other scenarios that may be encountered.

Forest ownership in a landscape with significant development or agriculture:

RECOGNIZE that these properties can provide valuable wildlife habitat, even in very small blocks (<10 acres) if they provide habitat uncommon in or absent from the surrounding landscape.

If a property abuts other forested areas, **CONSIDER** keeping it as part of a contiguous forest block, especially if it approaches or exceeds 250 acres. The older forest habitat on these properties will balance the fields, yards, and young forest habitat types that may be more typical of the surrounding landscape.

EVALUATE the potential for the property to serve as a connector between other nearby forested areas. These corridors provide cover for birds and other wildlife that avoid large openings.

FEATHER edges from development or agriculture into managed forest so that habitat changes gradually between the two habitat types. Wider, more gradual transition zones can provide more nesting habitat and reduced predation and cowbird parasitism.

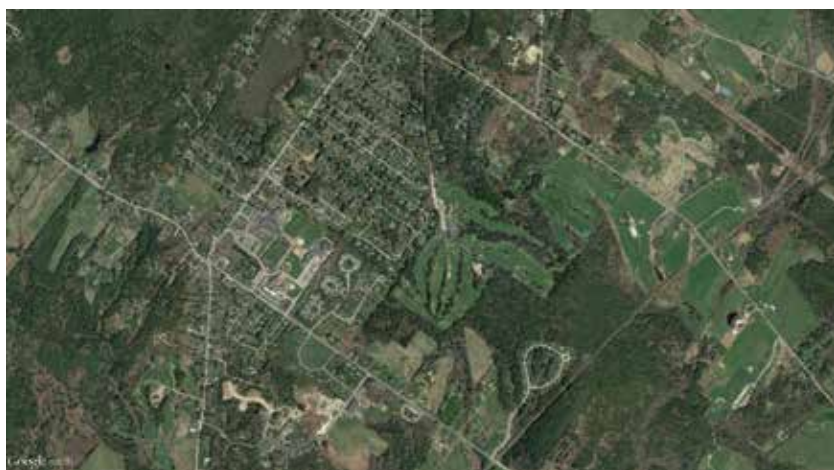


Figure 29. What is in the landscape around a woodlot can influence what type of management will benefit birds.

LANDSCAPE CONTEXT (CONT'D)

Forest ownership in a landscape with low to moderate percentage (<40%) older forest:

■ **PRIORITIZE** management for older-forest habitat on these ownerships to provide habitat lacking in the surrounding landscape.

■ On large ownerships, **DEVELOP** a long-term plan to reach the desired targets for older forest (40–50% FFMB Structure Class 4 and another 10% FFMB Structure Class 5, see Table 10, p. 84).



Figure 30. Creating or maintaining blocks of young forest on the landscape can provide valuable habitat, but may be a deterrent for interior forest birds if they are too large and fragment forest habitat.

Forest ownership in a landscape of predominantly older forests (>60%):

■ If the property is part of a large block of older forest (see previous section, p. 83), **CONSIDER** keeping it intact by managing to maintain older-forest characteristics.

■ **CREATE OR MAINTAIN** young forest to provide habitat that is less common in the surrounding landscape (Fig. 30). If possible, do so on the edges of large blocks, and maintain the FFMB goal of 10-20% of landscape acreage in young forest. Creating gaps less than two acres under a multi-aged silviculture strategy or regenerating stands with even-aged methods are two options to consider that are in line with FFMB management approaches in this landscape context.

■ **FINDING OUT MORE** about future management activity on surrounding lands can help guide long-term management. If the surrounding lands are likely to be heavily harvested, an increased emphasis on maintaining existing older forest habitat may be warranted.

BIGGER THAN BIRDS: MANAGING LARGE BLOCKS OF FOREST FOR CANADA LYNX AND AMERICAN MARTEN IN NORTHERN MAINE

Even the smallest woodlot can be home to many pairs of breeding songbirds and also provide benefits to other traveling migrants if the right habitat features are present. While managing for forest birds on a property can also benefit other wildlife species, some wildlife, especially larger mammals, have larger home ranges and will likely range across multiple properties in order to find the food, shelter and cover they need to survive.

American Marten American marten prefer mid- to late-successional forests with high canopy cover and complex physical structure. Protection from predators, safe resting sites, and access to prey are all enhanced by downed woody debris, snags, root mounds and other structures typically found in these older forests. Marten have large home ranges for their body size, averaging anywhere from 600 to 2,200 acres. Maintaining intact patches of 350 acres or more where trees are tall (>20') and average stand basal area is >80 ft²/acre will help meet marten habitat needs. Habitat quality will be improved by increasing basal area (>100 ft²/acre) and stand height (>40').



Canada Lynx Lynx feed primarily on snowshoe hare, which thrive in dense thickets of younger trees and shrubs. In Maine, the highest densities of snowshoe hare occur in regenerating softwood stands 15-35 years old, though older multi-storied stands with vigorous understory growth can support moderate hare densities. Lynx also need areas with high canopy cover and abundant downed trees to provide cover for denning and resting sites. Because lynx home ranges in Maine can exceed 20,000 acres, conservation planning for lynx can require coordination over two to four townships.



References: Simons 2009, McCollough 2007, Simons et al. 2010, Vashon et al. 2008

Even though the scale of forest management needed to create and enhance habitat for these two wide-ranging species is often beyond the footprint of any one individual landowner, small landowners can play a role in providing travel corridors or a portion of their habitat needs. Managing for marten and lynx will also benefit many of the priority FFMB species.

CASE STUDY: PROPERTY AND LANDSCAPE ASSESSMENTS

The tables and figures below are created from the templates provided in the Appendices, and are built from a hypothetical 430-acre property. The property has all stand structure classes represented, with the most (54%) in the intermediate stand structure class (3a and 3b) (Tables 11 and 12, Fig. 31). Just 25% of the property, however, is in the older stand structure classes.

Looking across the landscape (Table 13, Fig. 32), the property lies in an area that has more young and intermediate forest (and less older forest) on the landscape compared to FFMB guidelines (p. 84). The property's older forest therefore likely provides important features for FFMB priority species that are less common in other parts of the landscape.

Some forest practices that might improve this property for FFMB species include:

- Maintaining existing older stands.
- Enhancing intermediate stands with single tree removal or other multi-aged silvicultural practices that improve conditions for the establishment and growth of younger trees, as well as helping older trees expand crowns and increase growth rates.
- Planning for younger forests in small patches in coming decades, placing them to minimize fragmentation of existing blocks.

Additional case studies (including property maps that help illustrate how surrounding forest blocks might influence property management decisions) will be added over time at maineaudubon.org/FFMB.

Table 11. Sample Management Plan Table
(from template p. 124).

Stand Name/ID	Area (acres)	Forest Habitat Association*	Stand Structure Class*
1	20	Northern HW	1
2	60	Northern HW	3a
3	20	Northern HW	4
4	10	Northern HW	5
5	20	Northern SW	1
6	40	Northern SW	3a
7	30	Northern SW	3b
8	20	Northern SW	5
9	60	Oak Pine	4
10	50	Oak Pine	2
11	80	Oak Pine	3a
12	20	Oak Pine	3b

Table 12. Sample Forest Habitat Association Table (from template p.125).

Stand Structure Class*	Northern HW	Northern MW	Northern SW	Oak Pine	Total
1	20	0	20	0	40
2	0	0	0	50	50
3a	60	0	40	80	180
3b	0	0	30	20	50
4	20	0	0	60	80
5	10	0	20	0	30
Total (acres)	110	0	110	210	430

*1 (Seedling), 2 (Sapling), 3a (Intermediate Single-aged), 3b (Intermediate Two-aged), 4 (Maturing/Small Sawtimber), 5 (Older/Complex Large Sawtimber)

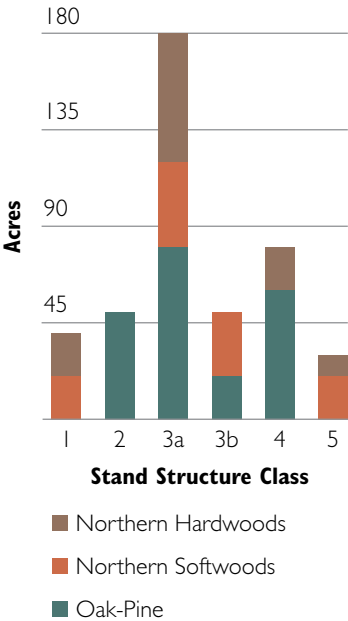
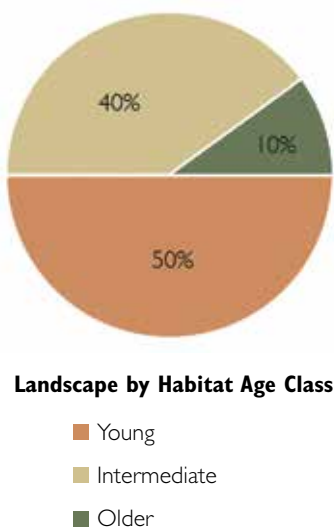


Figure 31. Case Study: Forest Types and Stand Structure Classes (data from Table 11). Stand structure class across the ownership shows almost half the ownership in the intermediate (3a) stage which offers limited value for most FFMB birds.



Landscape by Habitat Age Class

- Young
- Intermediate
- Older

Figure 32. Case Study: Habitat Age Classes Across the Landscape (data from Table 13). Young forest predominates the landscape. FFMB management should consider ways to enhance intermediate stage forests with more older forest structure.

Table 13. Sample Landscape Context Assessment estimated for approximately 2,500 acres around the property based on aerial photographs (from template p. 126).

Overall Forest Cover:	Forested — 70%		Non-Forested (ag, dev, suburban) — 30%	
Stand Structure Class:	Young—50%		Intermediate —40%	Older — 10%
Forest Blocks:	Block #	Size (acres)	Structure Class	Property part of block?
	1	500	Young	Yes
	2	800	Young	No
	3	400	Intermediate	Yes

STAND-SCALE MANAGEMENT FOR FFMB SPECIES

FFMB management aims to create desired habitat conditions (either now or in the future) that will attract birds to breed, feed, and raise their young. Managing for all species on any given stand is not necessarily feasible or desirable. Focusing on different features in different stands or in different time periods allows land managers to consider the sometimes conflicting habitat needs of all FFMB priority species.

The structural diversity of forest habitat is important for maintaining bird species diversity and abundance. As described in Section II, different FFMB species use different canopy layers, and some need special habitat features such as canopy gaps, snags, cavity trees, or dense leaf litter. Universal management for some of these attributes, such as snag and cavity tree density, may be possible on all managed stands. Other attributes such as high or low vegetative cover or small forest openings may be incorporated into only certain silvicultural options.

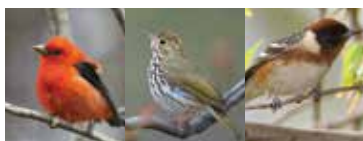
The following section reviews the different stand attributes evaluated in the FFMB stand assessment and includes one or more desired future habitat conditions that will meet the needs of FFMB priority species. Guidance is provided on silvicultural practices and systems that help bring about the desired future condition, as well as the FFMB species that are likely to benefit.

For a summary of habitat needs and management notes by Forest Habitat Association and bird species, see tables on pp. 102-109.

CURRENT AND FUTURE CONDITION OF VEGETATION LAYERS

In general, the more diverse the vegetation layers are in a forest, both in terms of density and vertical structure, the greater the quality and quantity of habitat for forest birds. Diverse vertical and horizontal structure provides the greatest number of FFMB priority birds the greatest number of nesting and foraging opportunities across the landscape.

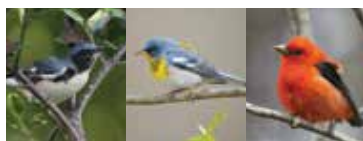
Overstory (>30'): Medium- to High Density



Scarlet Tanager; Ovenbird; Bay-breasted Warbler

- Multi-aged management will maintain medium to high overstory cover over time.
- Canopy cover will vary within a stand as openings to promote regeneration of desired species are created.
- Stands in even-aged management will take 30–40 years to attain low to medium overstory cover.
- If overstory cover is low but of good quality, allow it to increase over time.
- Focus on management of the understory while retaining a partial overstory for habitat structure.

Midstory (6–30'): Medium- to High-Density



Black-throated Blue Warbler; Northern Parula; Scarlet Tanager

- Multi-aged management is the preferred method for promoting and maintaining a robust mid-story. By periodically harvesting in the overstory, this management system promotes regeneration and midstory growth.
- With even-aged systems, mid-story development is generally limited to two-aged systems (e.g. extended shelterwood). In these cases, midstory habitat will be a transitional phase between young and older-forest habitat, offering limited value to many FFMB birds until the stand matures.

Many factors influence whether long-term management is focused on the overstory or the understory, including current stocking level, species composition, overstory timber quality, and landscape condition.

VEGETATION LAYERS cont'd.

Understory (1–6') and Ground Cover (<1'): Medium- to High-Density

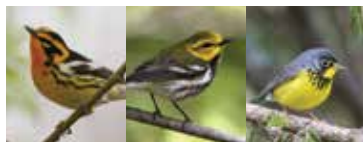


Canada Warbler; Mourning Warbler;
Chestnut-sided Warbler; Magnolia Warbler

- Multi-aged management promotes regeneration and shrub development in understory and ground layers through periodic harvesting in the overstory allowing light to reach lower canopy layers.
- In even-aged systems, a well-developed understory and ground cover is generally limited to older stands, the regeneration phase of a shelterwood harvest, and early stages of a two-aged stand (Fig. 33).

SOFTWOOD INCLUSIONS WITHIN HARDWOOD STANDS

Softwood inclusions provide additional structure and diversity within a hardwood stand that will attract additional species.



Blackburnian Warbler; Black-throated Green
Warbler; Canada Warbler

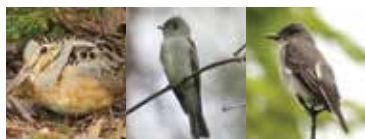
- In multi-aged management areas, retain clusters of softwoods and individual large-crowned softwoods in the overstory.
- Manage canopy to promote and maintain deep softwood crowns and promote softwood development in the understory.
- In even-aged systems, retain patches of softwoods and/or dispersed wind-firm individuals during regeneration harvests.



Figure 33. Dense understory in a two-aged stand.

CANOPY GAPS

As defined by the FFMB approach, canopy gaps are openings 0.25 to 2.0 acres in size within a larger forest stand. Canopy gaps are used as foraging habitat by many species. They can also be used as nesting habitat for young forest specialists and as post-fledging habitat for some mature forest birds when understory and regeneration are significant layer components.



American Woodcock; Eastern Wood-Pewee;
Olive-sided Flycatcher

- In multi-aged management, use group selection cuts to create a mosaic of gaps up to two acres in size. To maintain the integrity of closed-canopy habitat within the stand, limit the total area in gaps to no more than 20% of the stand area in any 20-year period.
- Consider creating gaps and openings of different sizes.
- Irregular shelterwood and group selection systems can be used to create gaps in stands for which even-age systems are preferred.

SNAGS AND CAVITY TREES

Snags, cavity trees, and live decaying trees provide important foraging and nesting habitat (Fig. 34).



Northern Flicker; Boreal Chickadee; Black-backed
Woodpecker; Yellow-bellied Sapsucker

- Larger snags (>12" DBH) accommodate larger-bodied birds such as Pileated Woodpeckers, Wood Ducks and Barred Owls. They also last longer as both snags and as coarse, woody material.
- Retain all snags if possible, but a minimum of six live cavity trees and/or snags per acre, with one >18" DBH and three >12" DBH. If no trees of these sizes are available, retain the largest that can be found.
- A mix of snags and live cavity and/or decaying trees distributed throughout the stand is preferred.
- Where snags are felled for safety reasons, leave in place to provide coarse woody material.
- Good candidates to retain for future snags include aspen and red maple, as well as others with broken tops, large dead limbs, or other signs of potential decay.

SNAGS cont'd.

- In older (Stand Structure Class 4 and 5 and older Class 3) stands with few snags or cavity trees, consider girdling some low-quality trees to create snags and/or retain some decaying trees that will develop into cavity trees and snags. Although girdling will provide some habitat, girdled trees do not last as long as snags that result from live trees decaying from the inside out.
- If using mechanical equipment, create snags by topping standing trees and placing woody material on the forest floor.



Figure 34. Snags provide an amazing number of benefits for species that excavate cavities and feed on beetles and other insects using the softer rotted wood. Many other species of wildlife, from raccoons to flying squirrels to bats will use cavities created by birds for many years to come.

COARSE AND FINE WOODY MATERIAL (CWM, FWM)

Downed coarse and fine woody material promote soil health and biodiversity, providing substrate for insects and other prey species as well as secure cover for nesting and resting forest birds. Guidance on management applies equally to all silvicultural systems.



Canada Warbler

- In stands that do not have medium or high levels of CWM or FWM, leave tops and occasional large, low-value logs to enhance this attribute. Mechanical logging can help with this effort.
- If possible, avoid crushing downed logs during logging operations. This helps protect their habitat value.
- If harvesting whole trees, retain on site or haul back and scatter tops, limbs, and smaller trees from 33% or more of the trees harvested.
- Maintain standing snags or cavity trees not only for current habitat value, but also as a way to recruit future CWM.

DECIDUOUS LEAF LITTER

Deep leaf litter (>1.5" thick) provides nesting habitat and foraging substrate for insect eaters. Leaf litter is only an important consideration in hardwood or hardwood-dominated mixedwood stands.

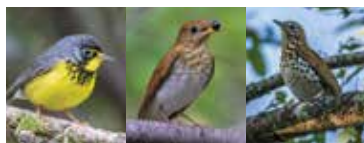


Ovenbird; American Woodcock

- Multi-aged management promotes desired leaf litter conditions.
- When using even-aged systems, shelterwood and two-aged systems will retain more leaf litter than clearcutting. However, leaf litter will recover after clearcutting as forest vegetation develops.
- Limit the potential to introduce invasive earthworms by advising landowners to store manure or compost away from hardwood and mixedwood stands.
- Pressure-wash logging equipment that has been used in non-forest areas to limit the risk of introducing invasive earthworms and invasive exotic plants.

RIPARIAN AND WETLAND FORESTS

Riparian and wetland forests protect water quality, help minimize risk from flooding, and provide habitat for many wildlife species. Vernal pools provide critical habitat for several amphibian species, and these species in turn support a wide variety of other wildlife.



Canada Warbler; Veery; Wood Thrush

- Regulations for management in and around riparian and wetland forests vary based on the type and size of wetland or water body, as well as local shoreland zoning ordinances. Consult the Maine Forest Service for further assistance.
- Apply *Maine's Best Management Practices for Forestry* (Maine Department of Conservation 2017; see References, Appendix G) to protect water quality by controlling erosion and sediment.
- Refer to the *Focus Species Forestry* (Bryan 2007; see References, Appendix G) for specific management recommendations for riparian zones. Riparian management zones benefit many wildlife species that use habitat as much as several hundred feet or more from the water's edge and are typically wider than BMP water quality buffer zones.

RIPARIAN cont'd.

- Refer to *Vernal Pool Habitat Management Guidelines* (Calhoun and deMaynadier 2004; see References, Appendix G) for specific management of riparian zone recommendations.

INSECTS AND DISEASES

As with exotic plants, invasive insects such as hemlock woolly adelgid and emerald ash borer threaten to significantly alter forest composition and ecology in fundamental and irreversible ways. Periodic outbreaks of other native and exotic insects and diseases can significantly change forest habitats.

- Learn to identify signs of invasive insects, and share this information with landowners.
- Check status reports on the Maine Forest Service website (See Appendix C for additional references).



Figure 35. Japanese Barberry is an invasive plant taking hold in Southern Maine.

INVASIVE EXOTIC PLANTS

Invasive exotic plants alter native forest composition and regeneration and do not provide the same food sources as native plants to which birds and other wildlife are adapted (Fig.35). Early detection and rapid response is the key to successful control and management of invasive exotic plants. Additional references on invasive exotic plants are included in Appendix C.

- Pressure-wash logging equipment before arriving on-site to prevent the introduction of seed and live roots from invasive plants. This is especially important in southern and central Maine, where invasive plants are found on many woodlots.
- Become familiar with the invasive species listed in the Appendices and note any observations of these species while out in the forest.
- Implement appropriate control measures. Small vines and shrubs may be pulled by hand, but treatment of stems with an herbicide may be the most effective means of controlling larger plants or large areas.
- Natural Resources Conservation Service (NRCS) cost-share assistance may be available for controlling invasive plants in your woodland. See Appendix G for contact information.

NOTES

FOREST MANAGEMENT “WITH BIRDS IN MIND”

By working with landowners to set goals, and then employing the principles and suggestions in *Forestry for Maine Birds* in management plans and prescriptions, you will help expand the acres of forest managed “with birds in mind” across the state. Below is a summary of the FFMB process and the top eleven actions to consider when implementing a plan and writing silvicultural prescriptions. Following the summary, four tables (one for each Forest Habitat Association) list the priority bird species and the habitat features they prefer. Printable versions of this table, summary pages, individual bird pages, data sheets, and other selected sections of this guide are available for download at maineaudubon.org/FFMB.

TRAIL MAP STEPS

When managing forests with birds in mind:

- Identify the landowner’s objectives
- Assess the habitat features on the property and across the landscape
- Examine the silvicultural options
- Enhance those options with FFMB strategies
- Capture this information in a forest management plan.

LANDSCAPE SCALE MANAGEMENT RECOMMENDATIONS

Consider context of forest conditions and activities in the surrounding landscape.

- When possible, create and enhance large (>250 acre) forest blocks dominated by intact canopy cover
- Where possible, target a landscape-level balance of 10–20% young forest, 30–40% intermediate-aged forest, 40–50% older forest, and ≥10% mature forest

Use multi-aged silvicultural systems where possible.

Where even-aged systems are more silviculturally appropriate, incorporate stand-level FFMB management strategies to enhance bird habitat.

STAND SCALE MANAGEMENT RECOMMENDATIONS

At the stand-scale, encourage vertical and horizontal structural diversity that promotes medium- to high-density understory, midstory, and overstory cover.

Promote structural diversity by fostering softwood inclusions in hardwood stands.

As appropriate to a stand, create canopy gaps 0.25 to 2.0 acres in size.

Retain and if needed, recruit snags and decaying trees where operationally safe to do so. The bigger, the better.

Retain coarse and fine woody material and deciduous leaf litter. Messy is good.

Address invasive plants, pests, and pathogens that threaten forest health and bird habitat.

Tread lightly in riparian areas and forested wetlands. Protect water quality and exceed BMPs to benefit forest birds and other wildlife as well.

Avoid harvesting during peak breeding season, between May 15 and July 31.

NORTHERN HARDWOOD SUMMARY TABLE

NORTHERN HARDWOOD	YOUNG	INTERMEDIATE	OLDER	MANAGEMENT NOTES	GAPS	AREA SENSITIVE	FOREST INTERIOR	MOIST SOIL OR RIPARIAN	SNAGS OR CAVITY TREES	CANOPY COVER	OVERSTORY (>30)	MIDSTORY (6-30)	UNDERSTORY (<6)	GROUND COVER	LEAF LITTER
Scarlet Tanager				Maintain or create well-stocked uneven-aged saw-timber stands with >80% cover especially those with a significant oak component and those embedded within larger blocks of mature forest (>250 acres).	×	×	×			>80%	HIGH	MED- HIGH			
Ovenbird				Maintain mature forest with med. to high canopy cover; within larger block of contiguous forest (>250 acres). Habitat affected 300' or more from edge of forest management activities. Prefers less ground cover; deeper leaf litter for domed ground nest.	×	×	×			60- 90%	HIGH	MED- HIGH		LOW	×
Wood Thrush				Maintain or create well-stocked uneven aged sawtimber stands with tall trees, >80% canopy cover; diverse species and moist leaf litter. Generally more productive in larger forest blocks of contiguous forest habitat (>250 acres).	×	×	×	×		>50%	MED- HIGH	MED	MED	LOW	
Yellow-bellied Sapsucker				Retain larger snags and potential snags or live trees with decay, especially aspen and birch. Will use inter-mediate forest if snags are present.	×	×			×						
Black-throated Blue Warbler				Maintain or create NH or NM stands with 50-80% canopy cover and dense understory. Responds well to low-intensity cutting where canopy is closed and openings allow for patches of regeneration. Prefers larger forest blocks (>250 acres).	×	×	×			50- 80%	MED- HIGH	MED- HIGH	HIGH		

NORTHERN MIXEDWOOD SUMMARY TABLE

NORTHERN MIXEDWOOD	YOUNG	INTERMEDIATE	OLDER	MANAGEMENT NOTES	GAPS	AREA SENSITIVE	FOREST INTERIOR	MOIST SOIL OR RIPARIAN	SNAGS OR CAVITY TREES	CANOPY COVER	OVERSTORY (>30)	MIDSTORY (6-30)	UNDERSTORY (<6)	GROUND COVER	LEAF LITTER
Black-throated Blue Warbler				Maintain or create NH or NM stands with 50-80% canopy cover and dense understory. Responds well to low-intensity cutting where canopy is closed and openings allow for patches of regeneration. Prefers larger forest blocks (>250 acres).		×	×			50-80%	MED-HIGH	MED-HIGH	HIGH		
Black-throated Green Warbler				Maintain or create well-stocked uneven-aged sawtimber NM and NS stands with >80% canopy cover, especially softwood inclusions and hemlock.		×	×			>80%			HIGH		
Blackburnian Warbler				Maintain large conifers and larger forest blocks (>250 acres). Uses bearded lichen.			×			>80%		HIGH			
Bay-breasted Warbler				Maintain mature softwood stands with tall trees, high canopy cover and dense midstory. Spruce budworm specialist, will use younger forests if spruce budworm present.		×					HIGH	HIGH			
Northern Parula				Maintain larger (>250 acres) blocks of tall, mature coniferous forest. Presence of bearded lichen essential.			×	×		>80%	HIGH	MED-HIGH	MED-HIGH		
Scarlet Tanager				Maintain or create well-stocked uneven-aged sawtimber stands with >80% cover, especially those with a significant oak component and those embedded within larger blocks of mature forest (>250 acres).		×	×			>80%	HIGH	MED-HIGH			

Canada Warbler				Maintain or create NM stands with 50-70% canopy cover and a dense under- and midstory. Uneven forest floor with woody debris (stumps, logs, upturned tree roots) preferred.	×	×		×		50-70%	HIGH	HIGH	MED-HIGH	
Magnolia Warbler				Use selective cutting within more mature stand to create openings of shrubby conifer growth, its ideal habitat.	×					30-60%	MED-LOW	HIGH		
Chestnut-sided Warbler				Maintain or create seedling/sapling stands >1 acre in size with <30% canopy cover. Needs larger saplings for singing perches. Will use intermediate/older forest if gaps present.	×					<30%	LOW	LOW	HIGH	MED-HIGH
Mourning Warbler				Maintain or create early successional stands. Increase sapling density, understorey cover, and canopy openings. Will use newly cut areas 2-10 years old. Will use intermediate /older forest if gaps present.	×					<30%	LOW	MED	HIGH	HIGH
American Woodcock				Maintain or create forest matrix with mix of openings and young forest in early stages of regeneration (<20 years old) preferably near shrubby wetland (FMI, timberdoodle.org).	×			×		VAR-ABLE	HI-LOW	HI-LOW	HI-LOW	×
Northern Flicker				Retain current and future large snags. More open park-like woods preferred, especially if habitat for ants, which are a preferred food source. Will use younger forest if snags present.				×		> 12" DBH	LOW	LOW-OPEN		LOW

BOLD—Species that prefer Northern Mixedwood (others will use Northern Mixedwood); Orange=Preferred Stand Structure Class; Tan=Used Stand Structure Class; White=Rarely Used Stand Structure Class

NORTHERN SOFTWOOD SUMMARY TABLE

NORTHERN SOFTWOOD	YOUNG	INTERMEDIATE	OLDER	MANAGEMENT NOTES	GAPS	AREA SENSITIVE	FOREST INTERIOR	MOIST SOIL OR RIPARIAN	SNAGS OR CAVITY TREES	CANOPY COVER	OVERSTORY (>30')	MIDSTORY (6-30')	UNDERSTORY (<6')	GROUND COVER	LEAF LITTER
Bay-breasted Warbler				Maintain mature softwood stands with tall trees, high canopy cover and dense midstory. Spruce budworm specialist, will use younger forests if spruce budworm present.		×					HIGH	HIGH			
Northern Parula				Maintain larger (>250 acres) blocks of tall, mature coniferous forest. Presence of bearded lichen essential.			×	×		>80%	HIGH	MED-HIGH	MED-HIGH		
Black-throated Green Warbler				Maintain or create well-stocked uneven-aged sawtimber NM and NS stands with >80% canopy cover, especially softwood inclusions and hemlock.		×	×			>80%			HIGH		
Blackburnian Warbler				Maintain large conifers and larger forest blocks (>250 acres). Uses bearded lichen.			×			>80%		HIGH			
Black-backed Woodpecker				Retain larger snags and potential snags or live trees with decay. Presence of wood-boring beetles essential. In younger stands if snags present.					>12" DBH	>50%	MED-HIGH				
Boreal Chickadee				Maintain stands with abundant snags >12" DBH for cavity excavation. Retain spruce and balsam fir as preferred tree species. In younger stands if cavity trees present					×	>80%	HIGH				

Canada Warbler					×		×		×	50–70%	HIGH	HIGH	MED-HIGH
Veery						×	×	×		30–80%		HIGH	
Magnolia Warbler					×					30–60%	MED-LOW	HIGH	
Mourning Warbler					×					40–70%	MED	HIGH	
Olive-sided Flycatcher					×						MED		

BOLD=Species that prefer Northern Softwood (others will use Northern Softwood); Orange=Preferred Stand Structure Class; Tan=Used Stand Structure Class; White=Rarely Used Stand Structure Class

OAK PINE SUMMARY TABLE

OAK PINE	YOUNG	INTERMEDIATE	OLDER	MANAGEMENT NOTES	GAPS	AREA SENSITIVE	FOREST INTERIOR	MOIST SOIL OR RIPARIAN	SNAGS OR CAVITY TREES	CANOPY COVER	OVERSTORY (>30)	MIDSTORY (6-30)	UNDERSTORY (<6)	GROUND COVER	LEAF LITTER
Scarlet Tanager				Maintain or create well-stocked uneven-aged sawtimber stands with >80% cover, especially those with a significant oak component and those embedded within larger blocks of mature forest (>250 acres).		X	X			>80%	HIGH	MED-HIGH			
Ovenbird				Maintain mature forest with med. to high canopy cover, within larger block of contiguous forest (>250 acres). Habitat affected 300' or more from edge of forest management activities. Prefers less ground cover; deeper leaf litter for domed ground nest.		X	X			60-90%	HIGH	MED-HIGH		LOW	X
Wood Thrush				Maintain or create well-stocked uneven aged saw-timber stands with tall trees, >80% canopy cover; diverse species and moist leaf litter. Generally more productive in larger forest blocks of contiguous forest habitat (>250 acres).		X	X	X		>80%	MED-HIGH	MED	MED	LOW	
Black-throated Blue Warbler				Maintain or create NH or NM stands with 50-80% canopy cover and dense understory. Responds well to low-intensity cutting where canopy is closed and openings allow for patches of regeneration. Prefers larger forest blocks (>250 acres).		X	X			50-80%	MED-HIGH	MED-HIGH	HIGH		

Appendices

APPENDIX A. GLOSSARY

Definitions adapted from the *Society of American Foresters Forestry Dictionary*

Age class An interval into which age groupings of trees are divided, or a distinct grouping of similarly aged trees regenerating after a single natural event or management activity.

Area-sensitive Species whose occurrence or reproductive success is reduced in small habitat patches. Typically these species either require a relatively large habitat patch within which to live, or they occur in higher densities or are more productive in larger patches.

Canopy cover The proportion of the forest floor covered by the vertical projection of the overstory and midstory layers combined, or the cover of all vegetation more than six feet from the ground. Similar measure to canopy closure, which is used in many studies of bird habitat.

Cavity trees Live or dead trees with either natural or excavated holes that may be used by cavity nesting birds and other wildlife.

Clearcut A harvest method that removes essentially all trees in a stand.

Coarse woody material Downed logs and branches >6" in diameter and more than 4' long.

Crown The part of a tree or woody plant bearing live branches and foliage.

Cull Part of tree (trunk or branches) not suitable for use in market due to defects like rot or decay.

DBH Tree diameter at breast height (4.5' from ground).

Decay tree A live tree with cull sections suitable for cavity excavation, or diseased trees that are dying.

Edge habitat The area along the margins of forest stands or patches.

Even-aged silvicultural system Forest management that fosters a single-aged class of trees across a stand.

Fine woody material Limbs and branches <4" diameter, including logging slash and tops.

Forest Habitat Age Class The broadest level of wildlife habitat classification used in this guide that incorporates the concepts of stand age, tree size (height and diameter), and complexity, including density of overstory, midstory, and understory layers.

Forest Habitat Association

Group of related forest types that frequently grow near each other on the landscape.

Forest interior Wooded habitat that is roughly 300 or more feet from a forest edge (where forest meets open habitats, development, or other land use).

Gaps Definitions vary, but for this guide, canopy gaps are defined as openings in the overstory (or the combined overstory and midstory) that range from a quarter acre (roughly 100x100 feet) up to two acres.

Ground cover Woody plants <1' in height and all non-woody vegetation.

Group selection A multi-aged silvicultural system where trees are removed and new age classes are established in small groups, usually <1 acre.

Hardwoods Typically deciduous trees that lose their leaves each fall.

Habitat Places where animals and plants find what they need to survive and reproduce, including food, water, and shelter.

Irregular shelterwood A modified shelterwood system where retained trees are left throughout the stand.

Leaf litter Decomposing leaves on the forest floor release nutrients into the soil and also keep it moist. Leaf litter can make great nesting material, and can provide hiding places and protected spots for wildlife.

Mast Nuts, seeds, buds, or fruits of trees and shrubs that are eaten by wildlife. *Hard mast* includes hard nuts and seeds such as acorns, hickory nuts, and walnuts. *Soft mast* includes berries and fruits such as crabapples, blueberries, and serviceberries.

Midstory Woody vegetation 6–30' in height.

Multi-aged (Uneven-aged) silvicultural system Forest management that fosters three or more age classes of trees in the same general area or stand.

Overstory Woody vegetation >30' in height.

Patch Canopy openings from 2–5 acres in size.

Riparian and Wetland Forest

Forest that is located in conjunction with a wetland, on the bank of a river or stream or at the edge of a lake or tidewater.

Seed tree cut An even-aged silvicultural system where some mature trees are left standing to provide seed regeneration.

Shade-intolerant Tree species that need direct sunlight to thrive as seedlings and saplings.

Shelterwood An even-aged silvicultural system where most trees are cut, but those needed for sufficient shade and seed to produce a new age class are left. Shelterwoods can create even-aged stands if retained trees are grouped together in patches or strips, or uneven-aged stands if left throughout the stand (irregular shelterwood).

Silviculture The art and science of controlling the establishment, growth, composition, health, and quality of forests to meet the diverse needs and values of landowners and society on a sustainable basis.

Single tree selection Multi-aged silvicultural system where individual trees are removed more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration.

Snags Standing dead or dying trees.

Softwoods Typically coniferous tree species that have needles.

Stand An area of the forest that is relatively uniform in species composition/type, vegetation structure, and age which can be managed as a single unit.

Stand Structure Class The general structure of a stand based on age, size (DBH), height, and canopy cover of dominant trees.

Territory The area a male bird defends to successfully breed, nest, and raise young.

Understory Woody vegetation 1-6' in height.

Vegetation layer As used in this guide, one of three principle vegetation layers – understory, midstory, or overstory.

Vegetation layer cover The proportion of the forest floor covered by the vertical projection of the tree and/or shrub crowns of an individual forest vegetation layer (overstory, midstory, understory).

APPENDIX B. PRIORITIZATIONS USED FOR PRIORITY BIRD RANKING

PARTNERS IN FLIGHT (PIF)

Species Assessment Database

rmbo.org/pifassessment

The PIF Species Assessment Process is a peer-reviewed, scientific methodology for analyzing, evaluating, and categorizing information related to bird conservation. The online database includes scores for a wide range of conservation measures as well as background on the PIF assessment process. The PIF approach focuses on relatively common species in geographic areas where conservation actions can be most effective.

Bird Conservation Plan for Eastern Spruce-Hardwood Forest

<https://www.partnersinflight.org/wp-content/uploads/2017/03/Phys-Area-28-E-Spruce-Hardwood-Forest.pdf>

Written in 2000, the Eastern Spruce-Hardwood Forest plan helps meet the PIF goal of ensuring long-term maintenance of healthy populations of native landbirds. The plan identifies issues and opportunities facing non-game landbirds as well as priority habitats and suites of species for conservation planning and action in the region.

NORTH AMERICAN BIRD CONSERVATION INITIATIVE (NABCI)

Blueprint for the Design and Delivery of Bird Conservation in the Atlantic Northern Forest

www.acjv.org/documents/bcr14_blueprint.pdf

Completed in 2005, the Blueprint identifies highest priority habitats including coastal areas, freshwater wetlands, and spruce-fir forest (especially high-elevation forests) as well as priority species for conservation action. The plan is designed to foster conservation action by providing a framework linking projects to conservation goals.

MAINE'S WILDLIFE ACTION PLAN (WAP)

www.maine.gov/ifw/wildlife/reports/wap.html

Maine's 2015 Wildlife Action Plan is a shared vision for the state that identifies measures to conserve priority wildlife species and habitats. The draft 2015 Plan identifies 378 Species of Greatest Conservation Need. The Plan provides species-specific and habitat-based conservation actions to help prevent further species declines over the next ten years. The Maine Department of Inland Fisheries and Wildlife (MDIFW) collaborated with over 150 public and non-profit partners to draft the plan.

APPENDIX C. REFERENCES FOR INVASIVE FOREST PLANTS

MAINE FOREST SERVICE

http://www.maine.gov/dacf/mfs/forest_health/invasive_threats/index.htm

Fact sheets on pests and plants, online report forms, quarantine reports.

MAINE NATURAL AREAS PROGRAM

http://www.maine.gov/dacf/mnap/features/invasive_plants/invasives.htm

Focus on plants, includes fact sheets, state laws and regulations, links to outreach pieces and other resources, and links to use iMapInvasives online.

MAINE INVASIVE SPECIES NETWORK

<http://umaine.edu/invasivespecies/>

Brings together research, education, and outreach professionals who work with invasive species in Maine.

INVASIVE PLANT ATLAS OF NEW ENGLAND

<http://www.eddmaps.org/ipane/>

A citizen science initiative to build a comprehensive web accessible database of invasive and potentially invasive plants in New England in order to facilitate education and research. An important focus of the project is the early detection of, and rapid response to, new invasions.

MOST PROBLEMATIC TERRESTRIAL INVASIVE FOREST PLANTS IN MAINE

Common Name	Scientific Name	Habitat
Japanese barberry	<i>Berberis thunbergii</i>	Forest understory
Common buckthorn	<i>Rhamnus cathartica</i>	Forest understory
Glossy buckthorn	<i>Frangula alnus</i>	Forest understory
Honeysuckle	<i>Lonicera</i> sp.	Forest understory
Japanese knotweed	<i>Fallopia japonica</i>	Edges
Asiatic bittersweet	<i>Celastris orbiculata</i>	Edges, forest canopy vine
Multiflora rose	<i>Rosa multifloa</i>	Old field, edges
Autumn olive	<i>Elaeagnus umbellata</i>	Forest understory

APPENDIX D. FFMB STAND ASSESSMENT DATA FORMS

DETAILED TRAINING VERSION

Includes explanations and definitions of all requested assessment data. Refer to pages 68-70 for more information. A full page printable version of this datasheet is online at maineaudubon.org/FFMB. A shorter version of this datasheet is on p. 123 and may be preferable once you are familiar with the assessment.

STREAMLINED SHORTER VERSION

For use once familiar with all terminology and definitions (see pages 122-123). A full page printable version of this datasheet is online at maineaudubon.org/FFMB. For a more detailed version, see p. 116-121.



FFMB ASSESSMENT DATA FORM FOR STANDS (LONG VERSION)

A shorter version of this datasheet (p. 122-123) may be preferable once you are familiar with the assessment.

These data can supplement a traditional forest inventory or be a stand-alone assessment tool. Assessments may be completed for multiple plots within a stand or at each forest inventory cruise point. Alternatively, a single summary assessment can be made based on general observations within a stand (see Section III and pp. 68-70 for more detailed information about stand measures). The data collected for this assessment are qualitative estimates. There is no fixed plot size.

Landowner _____ Date _____

Forester _____ Weather _____

ID for stand, TBD by forester.	ID for plot and/or GPS point if using, TBD by forester.	Forest Type helps determine which birds might be present. Use one of the Common Forest Types listed below or use an alternative classification system that provides similar level of detail.
Stand ID	Plot ID or GPS	Forest Habitat Association
Forest Habitat Association	Common Forest Types	Comments
Northern Hardwoods	Northern Hardwoods (beech-birch-maple and variants) Aspen-birch (early successional)	May include up to 25% softwoods
Northern Mixed-woods	Northern Hardwood/Hemlock Northern Hardwood/Spruce-Fir Hemlock (in patches)	Transitional between northern hardwoods and northern softwoods

Forest Habitat Association	Common Forest Types	Comments
Northern Softwoods	Spruce-Fir Spruce-Hemlock Northern White pine/ Mixed Conifer Northern White Cedar Aspen-birch (early successional)	May include up to 25% hardwoods
Oak-Pine	Northern Red Oak Red Oak- Mixed Hardwoods Red Oak-White Pine-Red Maple White Pine Hemlock and Hemlock- Oak-Pine Aspen-birch (early successional)	May range from pure oak-dominated hardwoods to mixed hardwood and softwood stands

Stand Structure Class describes the general structure of a stand. FFMB species in general prefer more complex vertical and horizontal structure. FFMB promotes a mix of these classes across the landscape, with particular attention to older classes (4 and 5).

Stand Structure Class (circle one number)			
Young	1	Regeneration	0-10 years old, <1"DBH
	2	Sapling	1-4" DBH, 10-30' midstory >80% cover, <30% overstory cover*
Intermediate	3a	Intermediate Single-aged	5-10" DBH, 30-70% overstory cover, midstory cover <30%
	3b	Intermediate Two-aged	5-10" DBH, 30-70% overstory cover, midstory cover >30%
Older	4	Maturing/Small Sawtimber	>70% canopy cover**, overstory trees 10-16" DBH dominant
	5	Older Complex/Large Sawtimber	>70% canopy cover, overstory trees >16" DBH dominant. Multiple canopy layers common

**layer cover is the percent of the forest floor covered by the vertical projection of each vegetation layer (overstory, midstory, etc.)*

***canopy cover is the overstory and midstory combined.*

Where FFMB species are found depends in part on the structure and arrangement of the live vegetation within the forest. Some species prefer a closed canopy, where little sun reaches the forest floor and understory vegetation is sparse. Other species prefer an open canopy with very dense understory or ground cover, and still other species use small gap openings within a broader closed canopy.					
OVERSTORY (>30')					
Dominant Species	Layer Cover Very Low (<5%) Low (5-30%) Medium (30-70%) High (>70%)	Composition H (>75% HW) HS (50-75% HW) SH (50-75% SW) S (>75% SW)	Canopy Height 0-10' 10-30' 30-60' >60'	Gaps Present? Y or N How many? ____ Approx. size? <.25 acres 0.25-0.5 acres 0.5-1 acres 1-2 acres >2 acres	
List in order of relative dominance. In hardwoods, be sure to note softwood inclusions, even if only a minor component.	Estimate % of forest floor covered by the vertical projection of the overstory layer and circle one. See guide below.	Circle one.	Height range of dominant and co-dominant trees. Circle one.	Estimate how many per acre or % of stand with gaps. Note the average gap size.	

MIDSTORY (6-30')				CANOPY COVER (>6')
Dominant Species	Layer Cover	Composition		Very Low (<5%) Low (5-30%) Medium (30-70%) High (>70%)
Same as above but for midstory layer.	Very Low (<5%) Low (5-30%) Medium (30-70%) High (>70%) Same as above but for midstory layer.	H (>75% HW) HS (50-75% HW) SH (50-75% SW) S (>75% SW) Same as above but for midstory layer.		The percent of the forest floor covered by the vertical projection of all vegetation over 6' (overstory cover + midstory cover – overlap).
UNDERSTORY (1-6' woody material)				GROUND COVER (<1' woody or taller herbaceous)
Dominant Species	Layer Cover	Layer Cover		
Same as above but for understory layer.	Very Low (<5%) Low (5-30%) Medium (30-70%) High (>70%) Same as above but for understory layer.	Very Low (<5%) Low (5-30%) Medium (30-70%) High (>70%) For ground cover layer.		

Guidance for estimating % cover/closure (view up through layer to sky):



<p>The dead components within a forest stand are important to many FFMIB species, as well as to other forest wildlife. The insects attracted to dead and decaying wood can provide an abundant food source, and the structure of dead wood in the forest (especially snags) provides nesting and resting sites. Litter and other fine woody material on the forest floor provides foraging opportunities, and for some species, places to nest.</p>			
SNAGS/CAVITY/DECAY TREES:	COARSE WOODY MATERIAL (CWM)	FINE WOODY MATERIAL (FWM)	HARDWOOD LEAF LITTER
# Small (<9" DBH): _____	<p>High, >20 pieces (abundant throughout, difficult to walk in places)</p> <p>Medium, 6-20 pieces (scattered throughout, occasionally need to step over pieces.)</p> <p>Low, <6 pieces (few/no pieces; easy to walk through; park-like)</p>	High, >5 piles	Adequate (>1.5" thick during spring and summer)
# Medium (9-12" DBH): _____			
# Large (12-18" DBH): _____		Medium, 1-4 piles	
# Very Large (>18" DBH): _____		Low, none	Not Adequate (<1.5" thick during spring and summer)
Count # >6' tall: Snags = standing dead/dying tree Cavity = alive/dead tree w/nest holes; Decay = live trees with decay or cull sections suitable for cavity excavation	Count # logs/branches on forest floor >6" diameter and >4' in length or standing <6' tall. Circle one.	Count # piles of small branches/tops/slash. Circle one.	Not Applicable (S stands)
Estimate average leaf litter layer thickness. Circle one.			

Invasive plants outcompete native plants, and do not provide the same ecological benefits to FFMB species or other wildlife. The fruits of many invasive plants are not as nutritious as native plants, and in fact, for birds, some act as diuretics. Exotic insects may contribute to significant decline or death of some tree species.		Forested wetlands provide important habitat for many FFMB species. Food may be more abundant in these wetlands, and the structurally complex forest floor around these wetlands provides good nesting and hiding places.	
INVASIVE PLANTS		INSECTS AND DISEASE	RIPARIAN AND FORESTED WETLANDS
Species:		% Cover:	
List in order of relative dominance. Estimate % of forest floor covered by each species.		Record evidence of damaging pests or pathogens.	Note if present in the area.

FFMB STAND ASSESSMENT DATA FORM, SHORT VERSION

A full page printable version of this datasheet is online at maineaudubon.org/FFMB.

Landowner _____ Lot _____ Date _____

Ground Conditions _____ Forester _____

Stand(s) _____ Weather _____

Notes:

Stand ID	Plot ID or GPS	Forest Habitat Association			Stand Structure Class
Overstory (>30')					
Dominant Species		% Cover	Composition	Canopy Height	Gaps?
Midstory (6-30')					
Dominant Species		% Cover	Composition	% Cover	
Understory (1-6')					
Dominant Species		% Cover	% Cover		
Snags/Cavity/Decay Trees		Coarse Woody Material	Fine Woody Material	Hardwood Leaf Litter	
# Small : _____ # Medium: _____ # Large _____ # Very Large: _____					
Invasive Plants		Insects and Disease		Riparian and Forested Wetlands	
Species	% Cover:				

APPENDIX E. FFMB PROPERTY SUMMARY FORMS

MANAGEMENT PLAN TABLE

Tally the area, habitat association and structure class for each stand across the property. A full page printable version of this datasheet is online at maineaudubon.org/FFMB.

STAND NAME/ID	AREA (ACRES)	FOREST HABITAT ASSOCIATION	STAND STRUCTURE CLASS	COMMENT

FOREST HABITAT ASSOCIATION TABLE

From the management plan table on the preceding page, calculate acres or percentage of property in each stand structure class. For stands not assessed by FFMB, calculate from forest cover type maps or other stand cruise data. A full page printable version of this datasheet is online at maineaudubon.org/FFMB.

STAND STRUCTURE CLASS*	NORTHERN HW	NORTHERN MW	NORTHERN SW	OAK-PINE	TOTAL
1 Seedling					
2 Sapling					
3a Intermediate Single-aged					
3b Intermediate Two-aged					
4 Maturing/Small Sawtimber					
5 Older/Complex Large Sawtimber					
Total					
Comments:					
Property-wide habitat management recommendations:					

* For definitions, see page 53.

APPENDIX F. FFMB LANDSCAPE CONTEXT ASSESSMENT FORM

Estimate the percentages of cover, stand structure class, and block size within the surrounding ~2,500 acres of a property. A full page printable version of this datasheet is online at maineaudubon.org/FFMB.

OVERALL COVER (%)	FORESTED	NON-FORESTED
COMMENTS		

Do not include water when calculating percent cover. Base percentages on vegetated areas only.

STAND STRUCTURE CLASS (%)	YOUNG	INTERMEDIATE	OLDER
COMMENTS			

See Stand Assessment Data Form for definitions of Older, Intermediate, and Young forest.

FOREST BLOCK SIZE (ACRES)	BLOCK #	SIZE (ACRES)	STAND STRUCTURE CLASS
COMMENTS			

Forest Blocks are areas of contiguous forest not divided by roads and non-forest habitats. May include smaller roads with narrow (<30 ft.) canopy gap (e.g. private driveways, small roads, etc.).

APPENDIX G.

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COST-SHARING

Natural Resources Conservation Service (NRCS): www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/

Maine Forest Service: www.maine.gov/dacf/mfs/

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