Forestry for Rhode Island Birds

A Guide for Foresters and Landowners to Manage Woodlots "With Birds in Mind"

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August 2019

A project of the Rhode Island Woodland Partnership, Managed by the Rhode Island Resource Conservation & Development Council (RI RC&D Council)

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Adapted from the original Vermont Foresters for the Birds Project created by Audubon Vermont and the Vermont Department of Forests, Parks, and Recreation, with additional support from the adapted Massachusetts guide, Managing Forests for Trees and Birds in Massachusetts, and the Maine guide, Forestry for Maine Birds. Relevant parts of those guides have, with permission, been used as part of the Forestry for Rhode Island Birds project. Authorial information for each of these guides is listed in the Acknowledgements section.

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This guide and the associate pocket guide are based on the original Vermont *Foresters for the Birds* project created by Audubon Vermont and the Vermont Department of Forests, Parks, and Recreation, with additional support from the adapted Massachusetts guide *Managing Forests for Trees and Birds in Massachusetts* and the Maine guide *Forestry for Maine Birds*. Other sources are cited throughout the document.

Original Program: Vermont *Foresters for the Birds* Project

Hagenbuch, S., Manaras, K., Shallow, J., Sharpless, K., & Snyder, M. (2011). *Birds with Silviculture in Mind: Birder's Dozen Pocket Guide for Vermont Foresters.* Audubon Vermont and the Vermont Department of Forests, Parks and Recreation.

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Gallo, S., Bryan, R., Mahaffey, A., Morrill, R., Morgan, D., Shultz, A., … & Wiley, J. (2017). *Forestry for Maine Birds: A Guidebook for Foresters Managing Woodlots "With Birds in Mind."* Maine Audubon.

INTRODUCTION

The woods of Rhode Island provide breeding habitat to dozens of threatened bird species. This is indicative of larger ecosystem problems, driven in part by habitat fragmentation and loss that impact bird breeding grounds, stopover habitats used during migration, and wintering habitat. Rhode Island is currently more than 55 percent forested, with the majority of woods owned by private landowners, but Rhode Island's forests are becoming increasingly fragmented due to urbanization. In the last five years, silvicultural practices focused on creating early successional habitats have been implemented in Rhode Island to support wildlife. While these management strategies are beneficial to certain wildlife species, they are not sufficient to support many forest-dependent birds that require larger tracts of mature forest or forest interior to thrive. Many of these bird populations are declining.

The *Forestry for Rhode Island Birds* project addresses threatened forest bird populations by educating landowners and natural resources professionals on the benefits of managing their land for forest-dependent bird species. Through this project, we have identified 12 bird species – referred to in this guide as the *Rhode Island Birder's Dozen* or "priority bird species" – that are emblematic of the conservation needs of forest birds in Rhode Island. This guide presents silvicultural activities to enhance the habitat types of forest-dependent bird species, with a focus on the Rhode Island Birder's Dozen. The project also involves implementing specific silvicultural guidance for restoring and enhancing the habitat of priority forest-dependent birds at demonstration sites throughout Rhode Island.

Pileated Woodpecker. Photo taken by Michelle St. Sauveur.

The *Forestry for Rhode Island Birds* project was developed over one year by partners connected to the RI Woodland Partnership and staff of the RI Resource Conservation & Development Council in collaboration with many independent Rhode Island foresters, ornithologists, ecologists and biologists. As described in the Acknowledgements, these materials were based, with permission, on those programs created in other New England states. In this guide, we provide considerations and tips to assist foresters in qualitatively assessing forest bird breeding habitat at the stand-level in the state's various forest types. This guide is intended to be used by foresters and landowners in conjunction with its companion documents: *SILVICULTURE WITH BIRDS IN MIND: BIRDER'S DOZEN POCKET GUIDE FOR RHODE ISLAND FORESTERS* and the *FORESTRY FOR RHODE ISLAND BIRDS JOB SHEET*.

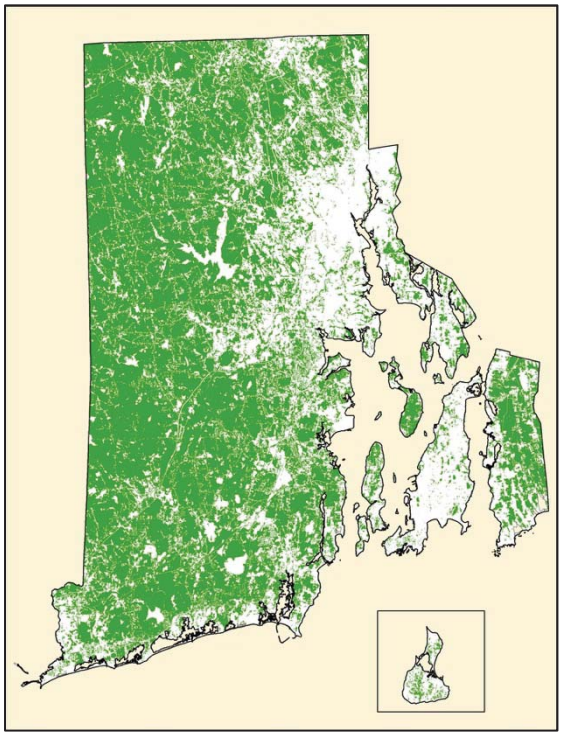
I. The Rhode Island Birders' Dozen

Based on the wide implementation of projects to address the creation of early successional habitat in the state, the RI Woodland Partnership decided to focus this guide on the needs of forest interior species and the management of their habitat. The Rhode Island Birder's Dozen is made up of twelve forest birds that represent priority habitat types of conservation need in Rhode Island and were selected by the Rhode Island Woodland Partnership with the assistance of ornithologists from the University of Rhode Island, the Rhode Island Bird Atlas 2.0, the North American Breeding Bird Survey (BBS), and the Audubon Society of Rhode Island, and in consultation with the 2015 Rhode Island Wildlife Action Plan and data collected from neighboring New England states. See Figure 2 for a depiction of the Rhode Island Birder's Dozen.

The silvicultural options discussed in this document have the potential to affect a diversity of forest birds and other wildlife. The Rhode Island Birder's Dozen will be used as species reference points to describe forest management tactics that can support populations of many other species in Rhode Island. The illustration below shows the Rhode Island Birder's Dozen, locating each species according to forest type and area of the woods where they are most commonly found nesting. The forest classifications used in this guide are: mature hardwood, mature softwood, hardwood/softwood mix, and forested wetlands (see page 13 for descriptions of these forest conditions).

These twelve species in the *Rhode Island Birder's Dozen* were selected because they:

- Are simple to identify by sight or sound;
- Collectively use a wide range of forest types and conditions for feeding and for breeding;
- Are showing a decline in their global breeding populations or are at risk for decline; and
- Are supported by large tracts of contiguous forest.



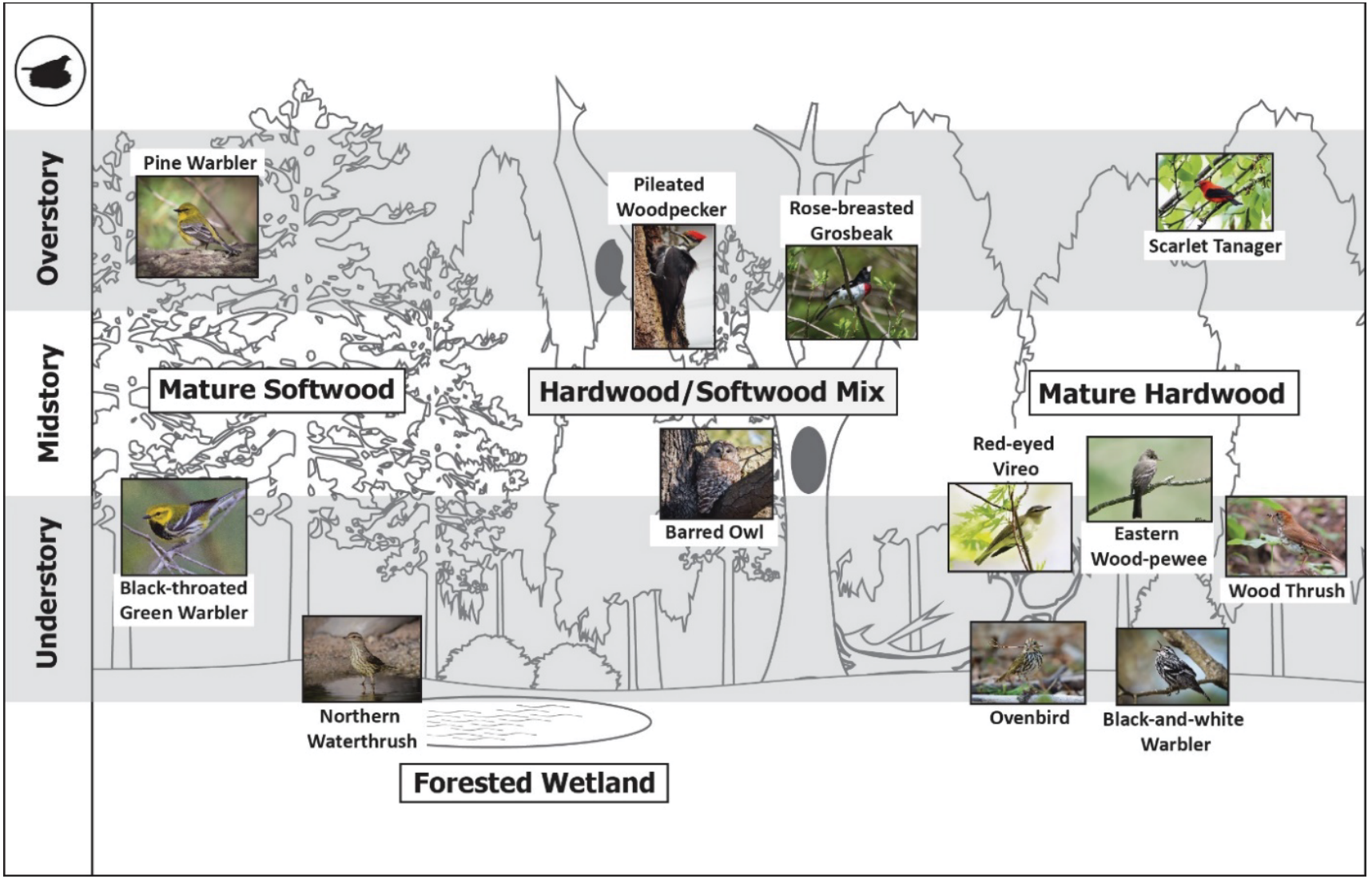


Figure 2: Where in the woods are the RI Birder's Dozen? Photos in this diagram appear with credits in the companion document Silviculture with Birds in Mind: Birder's Dozen Pocket Guide for Rhode Island Foresters

II. Rhode Island's Forested Land and Bird Habitat

Many bird species that breed in Rhode Island need large tracts of well-managed woods to survive and thrive. Landowners and foresters in Rhode Island can cultivate forest habitats that support birds by implementing the management suggestions outlined in this guide, including protecting contiguous tracts of woods, cultivating a diversity of forest age classes, addressing threats to key tree species, and sustaining habitat features that can attract and support the Rhode Island Birder's Dozen and other species of conservation concern in the state. By caring for forest-dependent bird populations, landowners and forest managers are also caring for the state's forest resources and providing habitat for a diverse array of non-avian wildlife. This section provides readers with regional and state context for bird habitat in Rhode Island and an overview of Rhode Island's forest resources.

Healthy Forests Are Critical for the Rhode Island Birder's Dozen

Rhode Island includes a diversity of habitats that support the state's bird populations. Rhode Island is part of the northeastern United States – an area extending from Maine to Virginia. The state contains three major topographic regions: (1) a coastal plain with elevations less than 100 feet extending along Narragansett Bay and along the state's southern coast; (2) a region of gently rolling uplands with elevations up to 200 feet to the north and east of Narragansett Bay; and (3) hilly uplands between 200 and 600 feet in elevation in the western part of the state (RI Wildlife Action Plan, 2015). *Ecoregions* are areas that share particular characteristics such as climate, soils, geology, fire regimes, and rainfall patterns. Although there are a number of different characterizations of Rhode Island's ecological communities, the Nature Conservancy's Northeast Terrestrial Habitat Classification System (NETHCS) is a useful grouping that divides Rhode Island and the broader Northeast region into wildlife habitats that include information on bird species important to the region. This system divides Rhode Island into two ecoregions – the North Atlantic Coast and the Lower New England/Northern Piedmont regions – and a number of different ecological systems[1] that are important to RI's birds (Ferree & Anderson, 2013). The 2015 RI Wildlife Action Plan (RI WAP) also classified state lands according to 84 Key Habitats and outlined species of conservation need associated with each habitat type.

As of 2015, 123 of Rhode Island's bird species were listed in the RI WAP as "species of greatest conservation need." This includes 24 forest bird species…

Many bird species depend on healthy habitat in Rhode Island. According to the RI WAP, the Northeast region is home to 110 bird species listed as regional species of greatest conservation need – 28 percent of all bird species in the region – and 34 species that are listed under the Federal Endangered Species Act. There are more than 430 species of birds documented in the state, making birds the most

[1] Ecological systems are recurring biological communities, defined based on biogeographic region, landscape scale, dominant cover type, and disturbance regime (Ferree & Anderson, 2013).

diverse vertebrate taxonomic group in Rhode Island. As of 2015, 123 of Rhode Island's bird species were listed in the RI WAP as "species of greatest conservation need." This includes 24 forest bird species (20 of which are forest-interior birds), the largest number of bird species of greatest conservation need listed in any habitat category.

▲

Forests are important to many of Rhode Island's birds, and unfragmented tracts of forested land are critical to supporting many of the Rhode Island Birder's Dozen and other forest-interior bird species. The Northeast region is both the most densely populated and heavily forested region in the United States (Dupigny-Giroux et al., 2018).

These are some key facts about Rhode Island's forested landscape:

- **Forested Area:** According to a 2017 assessment by the US Forest Service, Rhode Island has 368,000 acres of forests covering 55.6 percent of the land area in the state. There was a slight 1.3 percent increase in the state's forest between 2012 and 2017, although the state's forested land is facing significant development threats and forestland has decreased in "core forest" areas (Butler, 2018). See "Habitat Loss," page 18, for a longer discussion.
- **Forest Age:** The forests of Rhode Island are considered second-growth, established on land that was once cleared for agriculture. Forest stands in the Rhode Island are generally even-aged and include little that is very old or very young (D'Amato & Catanzaro, 2006; Roberts & King, 2017). As of 2015, the Northeast region was 60 percent forested, with an average forest age of 60 years and containing mostly small trees between 2 and 6 inches in diameter (RI WAP, 2015).
- **Forest Composition:** The most common forest community group in Rhode Island is oak/hickory, 61 percent of RI forests, followed by white/red/jack pine and maple/beech/birch. There were more than 46 species of trees inventoried on Forest Service plots in 2017, with the top ten species making up 91.1 percent of the volume of trees observed (Butler, 2018).
- **Forest Ownership:** Most of the woods in the northeastern United States and adjacent Canada are privately owned. An estimated 68 percent of woods in Rhode Island are privately-owned according to the US Forest Service 2017 inventory (DeGraaf, 2006; Butler, 2018). Figure 3 shows a breakdown of forested land by type of ownership.

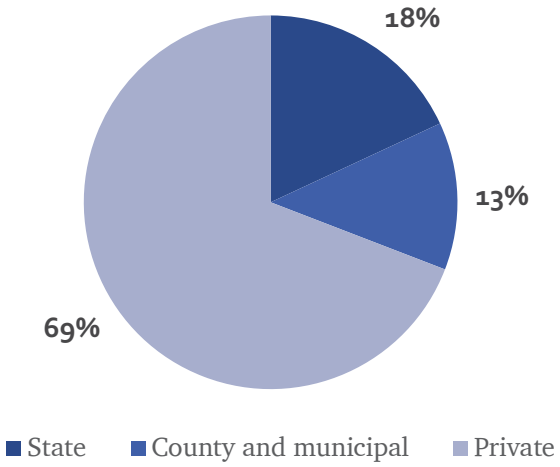


Figure 3: Forested Land Ownership in Rhode Island, 2017. Data from Butler, 2018.

- **Privately-Owned Woodland Parcels:** Most of Rhode Island's privately-owned woods are divided into small parcels of ownership. The National Woodland Owner Survey collects information on

family forest ownerships, and according to 2002-2006 survey results, the average size of a family-owned wooded parcel in Rhode Island was 6 acres (Butler, 2011). Landowners with at least 10 acres of woods surveyed between 2011-2013 owned an average of 17 acres (Butler, 2015).

When assessing conservation needs across Rhode Island's existing landscape, the 2015 RI Wildlife Action Plan identified "conservation opportunity areas" – priority areas where conservation goals can best be met and resources can be concentrated for maximum positive impact on wildlife (See Figure 5). These areas were mapped with consideration of: unfragmented forest blocks greater than 250 acres, habitats with high value and high vulnerability, habitats with important diversity, important coastal habitat (including "Important Bird Areas" as designated by the National Audubon Society), natural corridors, and freshwater restoration opportunity areas. Contiguous blocks of forested land greater than 250 acres, as depicted in Figure 4, are critically important for the success of forest-interior birds. Forested landscapes outside of these conservation opportunity areas, even small woodlots, remain important for bird populations – but these priority tracts of forest provide important benefits for many wildlife species and should be given special conservation consideration.

Monitoring Bird Populations in Rhode Island

Three significant volunteer-dependent efforts to monitor and track bird populations in the Northeast and across the country are: the Christmas Bird Count coordinated by the National Audubon Society, the Breeding Bird Survey (BBS) coordinated by the U.S. Fish & Wildlife Service, and eBird, a project of the Cornell Lab of Ornithology. These vital data sources are dependent on knowledgeable volunteers – every spring, more than 2,500 amateur birders and professional biologists volunteer to participate in the Breeding Bird Survey, thousands more volunteer for the Christmas Bird Count, and citizen scientists from around the world contribute more than 100 million bird sightings globally to eBird each year (USGS Patuxent Wildlife Research Center; Christmas Bird Count; "Ebird"). These rigorous volunteer data collection efforts are a shining example of citizen science at work.

At least six different survey routes have been undertaken in Rhode Island by the Breeding Bird Survey, although development and traffic along survey routes in Rhode Island has hindered the data collection process (RI WAP, 2015). A comprehensive Rhode Island Bird Atlas 2.0 is currently being developed to document breeding bird and winter bird activity across the state (RI Fish & Wildlife). These assessments allow conservationists, natural resource professionals, and all who appreciate the birds of Rhode Island to continue evaluating which populations are struggling and which are thriving, and take management action accordingly.

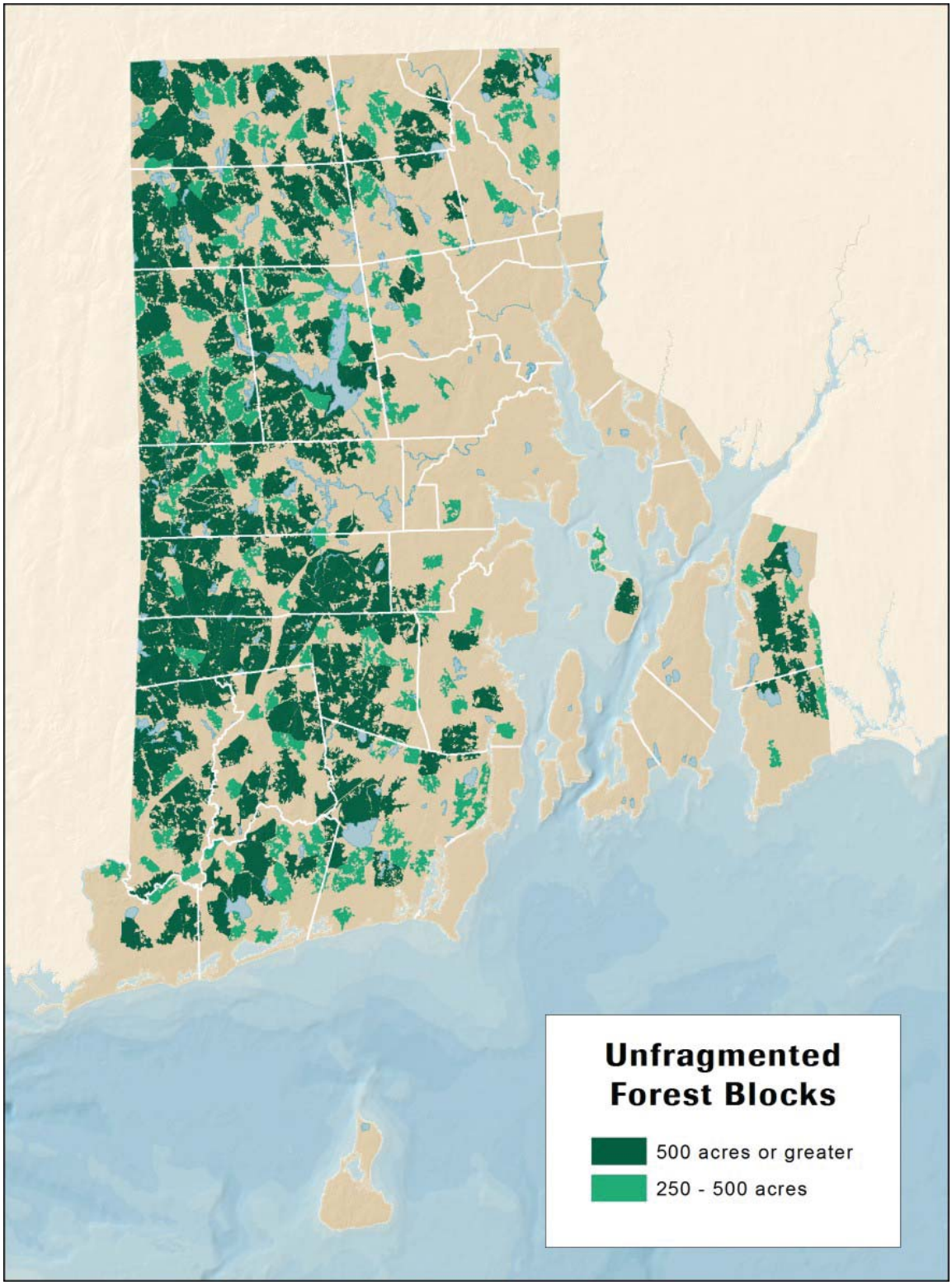


Figure 4: Map of RI Unfragmented Forest Blocks (>250 Acres) from RI WAP, Chapter 4.

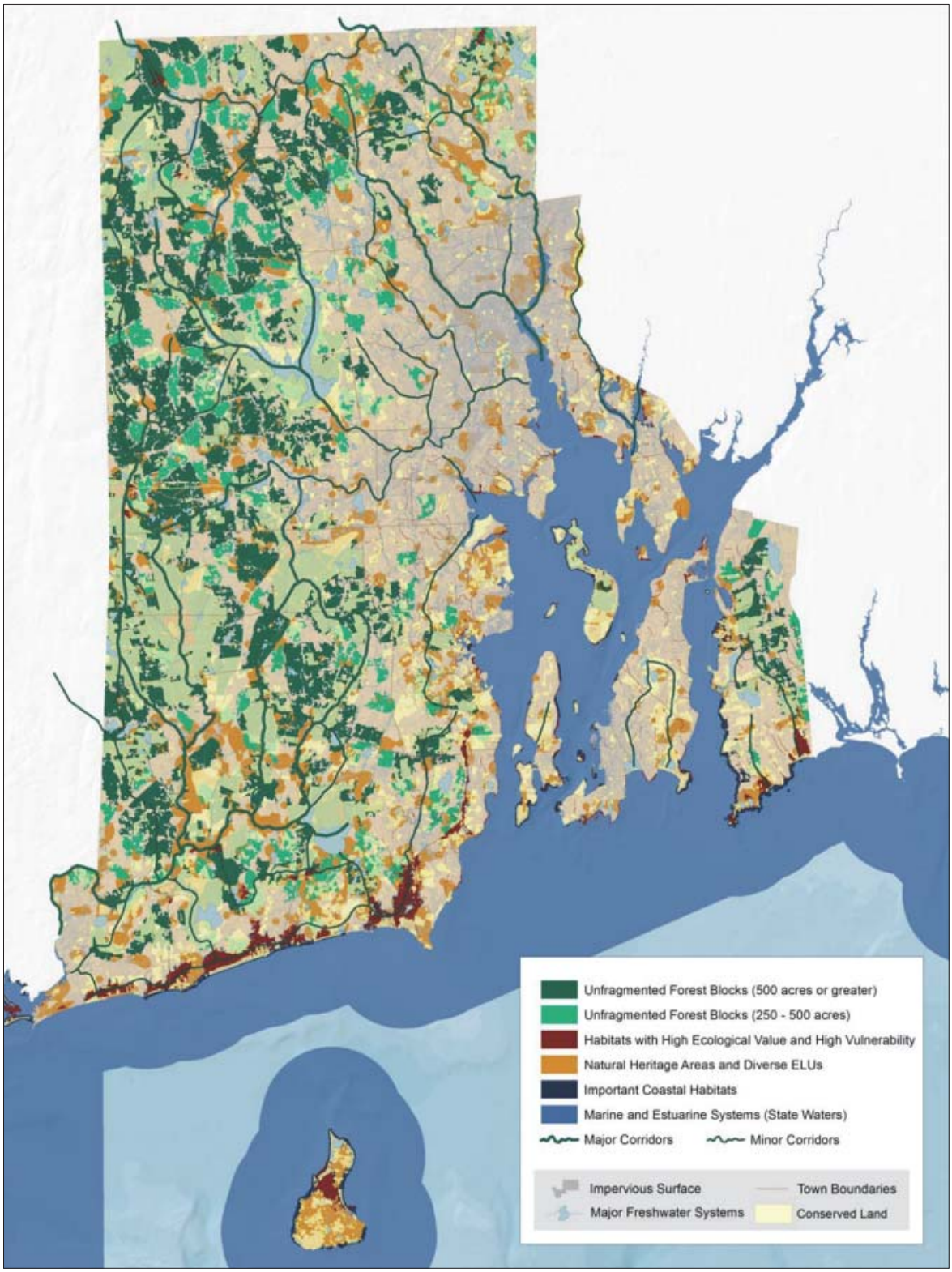


Figure 5: Rhode Island's Conservation Opportunity Areas from RI WAP, Chapter 4

Working with Private Landowners

Between 2002 and 2006, the U.S. Forest Service conducted a survey of families and individuals that own between 10 and 999 acres of woodland in the Northeast United States. According to this survey, most woodland owners own land for the beauty and scenery it brings and are seeking information about keeping the woods healthy, beautiful, and supportive to wildlife populations (USFS Family Forest Research Center, 2011). This creates a key opportunity for forest managers to work with landowners to create healthy forest habitat.

Many landowners want to cultivate their forested land to serve wildlife species but are under the impression that leaving their land alone and "letting nature take its course" is always the best management option for wildlife. This is often no longer the case, as a consequence of factors such as past land use that has resulted in mostly even-aged forests; the suppression of fire on the landscape; the introduction of invasive plants, animals, and pathogens to forest ecosystems; and the removal of top predators that control herbivore populations. Professional foresters can work with landowners to explain the management actions that support bird species. Foresters can help landowners understand realistic wildlife objectives, the temporary unsightliness of some forest management treatments, and the frequency of treatments needed for management protocols that will create healthy wildlife habitat (DeGraaf, et al., 2006). Funding to develop forest management plans is provided by the Natural Resources Conservation Service through the Environmental Quality Incentives Program (EQIP).

In Rhode Island, the RI Resource Conservation & Development Area Council manages the Rhode Island Coverts Project, an educational program for landowners that began in Connecticut and Vermont. The project teaches landowners about forest management techniques that can improve wildlife habitat and support diverse wildlife populations. Now in its 11th year, the project has trained 176 landowners from across the state who cumulatively own and manage 3,959 acres and manage another 6,179 acres for other people and groups. To date, the participants have entered into over $1.4 million in conservation contracts with USDA NRCS to implement forest and wildlife habitat management on their properties (Rhode Island Resource Conservation & Development Area Council).

Top to bottom: Black-throated Green Warbler, taken by Dan Berard; Eastern Wood-pewee, taken by Jen Leitao; and Pileated Woodpecker, taken in Lincoln Woods, RI by Russell Robinson.

Forest Conditions Used in the Forestry for RI Birds Guides

This guide divides forest conditions into the categories of mature hardwood, mature softwood, mixed hardwood and softwood, and forested wetlands. These broad categories were chosen by a group of ornithologists and foresters and can serve as a useful starting point when determining suitable conditions for forest bird species. We discuss the preferred habitat associations of the Rhode Island Birder's Dozen in this document, but these bird species represent a much larger number of forest-dependent bird species in Rhode Island. Preserving and maintaining a diversity of forest conditions in the state is a boon to hundreds of bird species and additional fauna that have not been detailed here. Table 1 shows the Rhode Island Birder's Dozen and other state bird populations organized by the four forest conditions used in this guide and by their primary forest habitat types according to the RI WAP classification system (non-forest habitat types are not included here).

Mature Hardwood

Mature hardwood forest refers to areas where mid- to late successional deciduous hardwood tree species dominate tree composition of the landscape (compose more than 80 percent of the forested area) (Butler, 2018). Hardwood species that occur in Rhode Island include scarlet oak, white oak, red oak, black oak, red maple, black gum, beech, birch, and aspen. Areas of mature hardwood are important to bird species that breed in Rhode Island, including these priority bird species: Scarlet Tanager, Wood Thrush, Black-and-white Warbler, Eastern Wood-pewee, Red-eyed Vireo, and Ovenbird. Hardwood forest natural communities include oak-hickory, oak-pine, maple-beech-birch, oak-gum-cypress, and aspen-birch.

Oak hardwood. Credit: Christopher Modisette

Mature Softwood

Mature softwood forest refers to areas where late successional coniferous tree species dominate tree composition of the landscape (compose more than 80 percent of the forested area) (Butler, 2018). Softwood species that occur in Rhode Island include white pine, red pine, pitch pine, spruce, and hemlock. Areas of mature softwood are important to bird species that breed in Rhode Island, including the priority bird species of Pine Warbler and Black-throated Green Warbler. Softwood natural communities include pine-oak, hemlock, and pitch pine.

Mixture of Hardwood and Softwood

Mixed hardwood and softwood forest refers to areas where neither hardwood tree species nor softwood species make up more than 80 percent of the forested area. Areas of mixed hardwood and softwood composition are important to bird species that breed in Rhode Island, including the priority bird species of Pileated Woodpecker, Barred Owl, and Rose-breasted Grosbeak. Mixed hardwood and softwood forest communities include oak-pine, eastern hemlock-hardwood forest, and hemlock.

Forested Wetlands

Forested wetlands refer to areas where tree species dominate an area in which water covers

the soil or is near the surface of the soil for varying periods of time during the year (Rhode Island Department of Environmental Management, 2008). These areas are also referred to as swamps or wooded wetlands. About 11 percent of Rhode Island's landscape consists of freshwater wetlands and most of this land area (48,182 acres total) consists of forested wetlands dominated by red maple.

The vast majority of wetlands in the state are privately-owned (RI WAP, 2015). Forested wetlands include Atlantic white cedar swamp and red maple-ash swamp communities (Butler, 2018). Forested wetland communities provide important breeding habitat to numerous birds in Rhode Island, like the priority bird species Northern Waterthrush. Among the attributes of forested wetlands are low average canopy height and abundance of ground cover, primarily ferns and shrubs. Structurally complex forest floors with hummocks, rootballs, and downed woody debris provide concealment for nests and young.

Hardwood/softwood mixed forest, Richmond, RI. Credit: Marc Tremblay

TABLE 1: RI FOREST HABITATS AND ASSOCIATED BIRD SPECIES

Forestry for RI Birds Habitat Condition	RI Wildlife Action Plan Habitat Type	RI Wildlife Action Plan Habitat Description	Associated Bird Species (RI Species of Greatest Conservation Need and Rhode Island Birder's Dozen)	Examples of Habitat in RI
Forested Wetlands	Hemlock Forest/Swamp	Forested wetlands of poorly drained acidic mineral substrates found throughout central New England. Eastern hemlock is the dominant coniferous tree cover (75-100%).	Northern Waterthrush, Northern Goshawk, Ruffed Grouse, Blackburnian Warbler	Inland, usually above 300 feet in elevation. Best examples in state management areas in Burrillville and Glocester.
Forested Wetlands	Deciduous Forested Swamp	The normal successional development of open wetland habitats in this region results in mature forested swamps. Most are dominated by red maple.	Northern Goshawk, Wood Duck, Canada Warbler, Northern Waterthrush, Prothonotary Warbler	
Forested Wetlands	White Cedar Swamp	Atlantic white cedar forms extensive coniferous forested swamps. Atlantic white cedar almost always (>99%) occurs in wetlands, on peatlands in poorly drained depressions, along stream and pond edges, and at the edges of bogs and fens.	Black-throated Green Warbler	Larger (>100 acres) examples found in Washington County at Crandall Swamp in Westerly, Indian Cedar Swamp in Charlestown, and The Great Swamp in South Kingstown
Mature Hardwood	Northern Hardwood Forest	Rhode Island lies on the southern periphery of northern hardwood forest range. These forests are comprised of sugar maple, American beech, and yellow birch, sometimes mixed with hemlock.	Black-throated Blue Warbler, Black-throated Green Warbler, Cerulean Warbler, Wood Thrush, Ovenbird, Eastern Wood-pewee, Barred Owl, Red-eyed Vireo	

Forestry for RI Birds Habitat Condition	RI Wildlife Action Plan Habitat Type	RI Wildlife Action Plan Habitat Description	Associated Bird Species (RI Species of Greatest Conservation Need and Rhode Island Birder's Dozen)	Examples of Habitat in RI
Mature Hardwood	Oak Forest	Deciduous forests dominated by oaks are the most widely distributed habitat type in Rhode Island. Most oak forests can be described as mixed oak communities, with variation most identifiable in the understory.	Ruffed Grouse, Veery, Yellow-billed Cuckoo, Northern Flicker, Pileated Woodpecker, Acadian Flycatcher, Wood Thrush, Black-and-white Warbler, Great Crested Flycatcher, Indigo Bunting, Rose-breasted Grosbeak, Hairy Woodpecker, Scarlet Tanager, American Woodcock, Northern Parula, Hooded Warbler, Prairie Warbler, Chestnut-sided Warbler, American Redstart, Blackpoll Warbler, Brown Thrasher, Blue-winged Warbler, Yellow-throated Vireo, Ovenbird, Eastern Wood-pewee, Barred Owl, Red-eyed Vireo	
Mature Softwood	Pitch Pine Woodland/Barren	Dry, fire-adapted communities with a variable canopy dominated by pitch pine and an understory of tall shrubs, especially scrub oak, and a low shrub layer of blueberry and other heaths.	Eastern Whip-poor-will, Black-billed Cuckoo, Nashville Warbler, Pine Warbler, Ovenbird	In two bands, one following the Charlestown recessional moraine and another in Arcadia Management Area running east.
Mixture of Hardwood and Softwood	Mixed Oak/Pitch Pine Forest	Mixed deciduous/coniferous forests of oaks and pitch pine typically occur in transitional areas between pitch pine dominated barrens habitats, and the more characteristic mixed oak forests of Rhode Island. Suppression of wild fires in recent years has resulted in the conversion of pitch pine dominated woodlands and barrens to mixed forests.	Pileated Woodpecker, Black-and-white Warbler	

Forestry for RI Birds Habitat Condition	RI Wildlife Action Plan Habitat Type	RI Wildlife Action Plan Habitat Description	Associated Bird Species (RI Species of Greatest Conservation Need and Rhode Island Birder's Dozen)	Examples of Habitat in RI
Mixture of Hardwood and Softwood	Mixed Oak/White Pine Forest	Forests in this category are a combination of mixed hardwoods (primarily oaks) and white pine, a coniferous tree which may constitute as much as 90% of the overstory.	Northern Goshawk, Least Flycatcher, Purple Finch, Yellow-rumped Warbler, Blackburnian Warbler, Blue-headed Vireo, Pine Warbler, Scarlet Tanager, Wood Thrush, Ovenbird, Eastern Wood-pewee	
Other	Ruderal Forest	Ruderal forests result from the significant modification of natural forest vegetation resulting in forest communities with no clearly known natural analogue. In Rhode Island, most ruderal forests are found in urban areas on lands set aside for parks, cemeteries, hospital grounds, schoolyards, and similar purposes.	Gray Catbird, American Woodcock	Within urban communities of Providence, Cranston, Warwick, among others.
Other	Floodplain Forest	Found along major rivers where annual flooding occurs, but where standing water is generally lacking during the rest of the year.		
Other	Maritime Woodland	A community of tall shrubs and small trees (up to 6 m tall) near the coast, comprised of dense woody vegetation with robust forms of maritime shrubs.	Gray Catbird, Eastern Towhee, Black-and-white Warbler, Ovenbird	Trustom Pond and Ninigret National Wildlife Refuges

III. Threats to Rhode Island's Birds

Threats to Rhode Island's forests also endanger bird species that depend on healthy forested habitat. The major threats impacting bird species in Rhode Island include habitat loss due to forest conversion and fragmentation; changes in forested land composition due to climate change; a lack of diversity in forest age classes; and pressure from non-native plant species. Below is a discussion of each of these threats.

Habitat Loss

In more developed parts of the Northeast region, including Rhode Island, threats to large tracts of forested land are a critical issue impacting wildlife. While the area of forested land in Rhode Island has not decreased in recent years, there has been a decline in large, unfragmented tracts of forest critical to forest-interior bird species (Butler, 2018; Buffum, 2019). Forestland that is converted for development is likely to be converted permanently, due to the nature of roads, buildings, and other human structures built for long-term use (Butler, 2007).

Habitat Conversion

Only 16 percent of land in the Northeast is protected and land conversion is out-pacing land protection in the region. One-third of forested land and one-quarter of wetlands in the Northeast have been converted to human uses from their natural states, and two-thirds of wetlands in the region have likely experienced adverse impacts from human activity due to their proximity to roadways (RI WAP, 2015). The Northeast region is densely populated, creating significant development pressure on forested land – Rhode Island is the second-most densely populated state in the United States. According to the Rhode Island Wildlife Action Plan, residential and commercial development is the threat impacting the most species of greatest conservation need in the state. Forested land is being impacted by a number of different forms of development in the state: home, school, workplace, and industrial developments to accommodate Rhode Island's growing population. Between 2011 and 2018, nearly 2,000 acres in "conservation opportunity areas" (COAs) identified in the RI Wildlife Action Plan were converted to non-forest land uses (Buffum 2019). See COAs in Figure 5.

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Between 2016 and 2018, there has also been significant deforestation pressure in Rhode Island from large-scale ground-mounted solar installations (State of RI Office of Energy Resources, 2018). Some of these installations clear large tracts of forested land to develop a renewable energy resource. This can reduce carbon dioxide emissions from the electricity sector, but it also compromises what was once a natural carbon sink, fragments the forest, and renders the area unfit for bird species needing large swaths of forest habitat. Given all the challenges facing forested land in the state, the Rhode Island Department of Environmental Management has prioritized increasing the size of Wildlife Management Areas under their control (RI WAP, 2015).

Habitat Fragmentation

Habitat fragmentation is a major threat to wildlife biodiversity. More than 732,000 miles

of permanent roads cut through forests in the Northeast region, and an average 43 percent of the forest is encircled by major roads in tracts of less than 5,000 acres (RI WAP, 2015). When forestland is converted to new development, as described above, the remaining forest is further fragmented and pressure increases on wildlife dependent on large tracts of forested habitat. When forested habitat is fragmented into smaller parcels, the resulting patches of forest are left with more edge habitat and less interior, compromising their suitability for a number of interior specialist forest bird species. The fragmentation of large forest patches into smaller, more complex pieces can change local water cycles, increase disturbances of wildlife habitat, and facilitate the infiltration of invasive species (RI WAP, 2015).

Climate Change

Climate change is a serious threat to bird species in Rhode Island. According to the most recent National Climate Assessment, the Northeast region of the United States is projected to experience an average temperature increase of 3.6 degrees Fahrenheit by 2035 over the preindustrial era – the largest increase of any region in the contiguous United States (Dupigny-Giroux et al., 2018). Rhode Island has been getting warmer and wetter since 1895 – annual precipitation is increasing at a rate of approximately 1 inch per decade and the mean annual temperature is rising at 0.2 degrees Fahrenheit per decade (RI WAP, 2015). In the near term, more frequent, extreme weather events fueled by climate change can impact forest structure in Rhode Island – studies show that this region will experience a greater frequency of high intensity storms and higher rates of rainfall (O'Rourke et al., 2018). Warming temperatures can also impact forest health by promoting earlier season emergence and an expanded range for tree pests like the hemlock woolly adelgid, emerald ash borer, and southern pine beetle. The timing of seasonal leaf appearance is already changing with warming temperatures and such changes can impact wildlife and critical ecosystem interactions (Dupigny-Giroux et al., 2018). Warming temperatures can cause increased competition for climate-threatened bird species in Rhode Island as other bird species' ranges expand (Langham et al., 2015).

In 2016, the Rhode Island Greenhouse Gas Emissions Reduction Plan…advised that meeting the state's emissions goals could be compromised by continued loss of forested land and recommended exploring a "no net-loss of forests" policy (p. 22).

Upland forests, including the oak-dominated forests in Rhode Island, are less vulnerable to negative impacts from a warming climate than northern hardwood forests. Over time, the populations of several dominant trees are likely to be reduced with rising temperatures and resulting competition from new species. Oaks may expand their range to include areas currently covered by northern hardwood forests (RI WAP, 2015; Dupigny-Giroux et al., 2018). Rhode Island will likely become more hospitable to southern tree species, causing changes in tree composition in the state and region. Research shows that trees in fragmented landscapes will have a compromised ability to migrate in response to climate change (Janowiak et al., 2018).

These changing conditions can significantly impact the ranges of bird species that migrate to and through Rhode Island to breed as well as those that winter here. The National Audubon Society created a report and interactive map that predicts how the ranges of 588 North American

bird species will be impacted by climate change. This report classifies many bird species as "climate endangered," defined as likely to lose more than 50 percent of their current range by 2050, or "climate threatened," defined as likely to lose more than 50 percent of their current range by 2080. Of the Rhode Island's Birder's Dozen, Audubon lists the Pine Warbler as climate endangered and the Scarlet Tanager, the Wood Thrush, the Black-and-white Warbler and the Black-throated Green Warbler as climate threatened (National Audubon Society, 2015).

Of the Rhode Island's Birder's Dozen, Audubon lists the Pine Warbler as climate endangered and the Scarlet Tanager, the Wood Thrush, the Black-and-white Warbler and the Black-throated Green Warbler as climate threatened.

Foresters can help private landowners prepare for the impacts of climate change by retaining or enhancing native tree species diversity – especially those native species expected to do well in a warming climate – and maintaining structural complexity and a range of age classes within the forest. 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 (Gallo et al., 2017). Forest managers should consider ways to promote carbon sequestration in forests while also managing forests to adapt to a warming climate and provide other ecosystem services. Rhode Island state organizations and agencies have identified the important role that well-managed forests play in mitigating climate change. In 2016, the Rhode Island Greenhouse Gas Emissions Reduction Plan prepared by the Executive Climate Change Coordinating Council advised that meeting the state's emissions goals could be compromised by continued loss of forested land and recommended exploring a "no net-loss of forests" policy (p. 22). The 2018 Statewide Climate Resilience Action Strategy identifies forests as a natural system that provides crucial services to communities and recommends that Rhode Island protect remaining forest cover, especially large, unbroken tracts of forested land, and support the development of Forest Management Plans to guide landowners in healthy forest management practices (O'Rourke et al., 2018).

In Rhode Island, some climate adaptation forestry is already underway. Providence Water is using the U.S. Forest Service's Climate Change Response Framework to conduct experimental plantings in forest stands around the Scituate Reservoir that include tree species adapted to likely future climate conditions. This project is aimed to improve current and future regeneration conditions that are being adversely impacted by deer browse, among other stressors (Climate Change Response Framework).

Balance of Age Classes

Historical clearing of forested land along with the decline in disturbances that create shrubland and young forest habitat has created a lack of diversity in forest age classes in Rhode Island. Declining shrubland and other early successional habitat is one critical issue impacting wildlife habitat in the Northeast region, and a number of programs have sprung up in the state to address this concern. As defined by the Atlantic Coast Joint Venture, early successional habitat is "habitat with vigorously growing grasses, forbs, shrubs and trees which provide excellent food and cover for wildlife but need disturbance to be maintained" (Atlantic Coast Joint Venture). Such habitats include weedy areas, grasslands,

old fields or pastures, shrub thickets, and young forest.

Post-colonization, vast swaths of the New England region were cleared to create farmland; this abandoned farmland became early successional forest habitat in the late 1800s to mid-1900s. Now, these areas have grown into mature forest and the vast majority of the state's forested land is second-growth forest (RI WAP, 2015). Historically, forested lands in New England also underwent frequent small-scale disturbances – like storms that downed groups of trees and forest fires set by humans and caused by lightening – that created young forest habitat, canopy gaps, and structural diversity in the forest (RI WAP, 2015). These natural disturbances no longer occur frequently. These changes have caused a decline in bird species that prefer shrubland and early successional young forest (DeGraaf, 2006). A 2011 study showed that shrubland habitat important to many declining bird populations is decreasing at a rate between 1.5 and 3.2 percent per year in non-coastal upland areas in Rhode Island. Sixty-two percent of Rhode Island shrubland habitat occurs in land areas without conservation status (Buffum, McWilliams & August, 2011).

In large enough parcels of forested land, creating a young forest patch on the landscape is a beneficial action a forester or landowner can take to support wildlife. There are a number of programs at the state and federal level that support the creation of young forest patches in Rhode Island, including the Young Forest Project sponsored by the Wildlife Management Institute and funding from the Environmental Quality Incentives Program (EQIP) through the Natural Resources Conservation Service (Fergus, 2014; USDA Natural Resources Conservation Service, "New England Cottontail Rabbit). The maintenance of powerline corridors and timber harvests can also create crucial young forest habitat. For example, researchers studying the American Woodcock and New England Cottontail in the Great Swamp Wildlife Management Area found that these species gravitate towards young forest created by both powerline right-of-ways and timber harvests (Wildlife Management Institute & other partners).

Invasive Species

A species is considered invasive if it meets two criteria: it's non-native to the ecosystem under consideration, and its introduction causes or is likely to cause economic or environmental harm or harm to human health (US Forest Service, "Invasive Species Program"). In 2012, 238 invasive species were identified in the Northeast that have the potential to adversely impact species of greatest conservation need in the region. Almost half (48 percent) of all invasive species identified were associated with forest edge habitat, demonstrating that the problem of invasive species can be exacerbated by habitat fragmentation that creates forest edge (Klopfer, 2012 as cited in RI WAP, 2015). The most common invasive plants in the southeastern New England region were multi-flora rose, Japanese barberry and oriental bittersweet, found on 19 percent of plots studied in 2007 (Butler et al., 2011). Three of the most significant forest invasive species impacting wildlife habitat in Rhode Island are Japanese barberry, glossy buckthorn and oriental bittersweet. Many of the rest (e.g. autumn olive, multi-flora rose, knotweed, and burning bush) are observed on field edges and fragmented forest areas.[2] Climate change can also exacerbate the problem

[2] Based on conversations with Rhode Island foresters reviewing this guide.

of invasive plants – many invasive species thrive in warmer climates and colonize opportunistically where native plants are stressed.

Although some species of native forest birds successfully use invasive shrubby, woody plant species as nesting sites and eat their fruits, the fruits generally have low nutritional value and the invasive plants reduce the diversity of other nesting and foraging options. In some cases, nest success has been shown to be lower in non-natives than in native vegetation. Overall, non-native, invasive plant species degrade the quality of native forest bird habitat in our region. Consideration and strategic and thoughtful control of non-native, invasive plant species – particularly early detection and rapid response to new threats – should be a management objective for every forester and landowner in Rhode Island. Foresters should consider the occurrence of invasive species when considering silvicultural treatments discussed in this publication and its companion document. When invasive species are present in the stand, they should be treated first to avoid further migration.

INVASIVE SPECIES THREATS: EMERALD ASH BORER AND GYPSY MOTH

Two of the most threatening tree pests currently impacting Rhode Island forests are the Gypsy Moth and the Emerald Ash Borer. Between 2015 and 2017, Rhode Island experienced a Gypsy Moth outbreak resulting in extensive hardwood defoliation across the state. By the end of 2016, Gypsy Moth defoliation had impacted an estimated 226,880 acres of tree canopy in the state – not including the significant defoliation that happened in 2017. Normal rainfall patterns in the spring of 2017 and 2018 helped contain the Gypsy Moth population and return it to normal levels (RI DEM, 2017). The full impacts of this extensive defoliation event over a series of years remain to be seen and will likely cause significant oak tree mortality. The RI Department of Environmental Management estimates that as much as 13 percent of the state's forest trees may be dead (As stated in Kuffner, 2018).

Gypsy moth. Credit: Scott Bauer, from USDA Flickr photostream.

Visible brown patches in July 26 photo due to gypsy moth defoliation. Credit: NASA Earth Observatory, Photo of the Day

OVERABUNDANCE OF WHITE-TAILED DEER

A lack of natural predators, a decrease in hunting, the spread of suburban landscapes with appealing forage for deer, and an increase in fragmented woodlands has caused a problematic increase in white-tailed deer populations and an adverse impact on forest regeneration. Over-browsing by deer populations stunts forest regeneration, promotes the proliferation of invasive plant species, and causes dramatic changes in forest composition overall. The RI Wildlife Action Plan notes that an overabundance of White-tailed Deer have contributed to a reduction in understory vegetation important to nesting birds (RI WAP, 2015). These changes in forest regeneration patterns and the composition of forest understories has a significant impact on breeding bird populations. When foresters are working with private landowners to create a forest management plan that includes concerns for bird species, this can be an important time for foresters to discuss the impacts of deer browse and landowner strategies for combatting this influence on their woodlands.

Management actions that can reduce the negative impacts of deer browsing include reducing deer numbers through increased hunting, leaving slash in place or piling it around the edges of small cuts to reduce deer access, and making large clearcuts to overwhelm deer with more browse than they can eat (DeGraaf, et al., 2006).

White-tailed Deer fawn in Scituate, RI. Credit: Patrick Randall, Flickr Creative Commons

IV. Habitat Assessment with Rhode Island Birds in Mind

Regional Assessment

Rhode Island is part of the Northeast region and includes two key ecoregions – the North Atlantic Coast and the Lower New England/Northern Piedmont regions. These ecoregions can be further divided into ecological communities that foresters can usefully consider when evaluating the suitability of a forested area for wildlife habitat (See Table 1). When analyzing the particular ecoregion and ecological community that a forested area falls into, foresters can consider:

1. Which species in the Rhode Island Birder's Dozen prefer this ecoregion and ecological community? (Consult the *Birder's Dozen Pocket Guide for Rhode Island Foresters.*) Which species of conservation concern reside in this region that I could support with my management actions?
2. What threats and regional dynamics are impacting this area that could influence the effectiveness of my management strategy to attract wildlife? For example, is there development pressure or pressure from invasive species in the area?

Landscape Assessment

Moving inward from the ecoregion, the next level to consider is the landscape immediately surrounding the property, which can have implications for stand-level habitat quality. A rule of thumb for thinking about the landscape from a bird perspective is to consider an area of approximately 2,500 acres. This is an area about the size of a circle with a 1-mile radius. Consider the composition (proportion of different land uses and forest ages) and configuration (size, shape, arrangement, and relative position of different land uses and forest ages) of the landscape surrounding the parcel in question. While landscape conditions are difficult to address through stand-level management, examining the existing landscape can help decide what management practices to perform – or not perform – and which bird species can be effectively managed for. A full explanation of landscape effects on habitat quality is beyond the scope of this document, but some general concepts are described in this section.

Recommendations in the "Habitat Assessment" and "Making Management Decisions" sections of this guide were adapted for Rhode Island from recommendations in *Forest Bird Habitat Assessment* developed by the Vermont Department of Forests, Parks, and Recreation and Audubon Vermont and *Managing Forests for Trees and Birds in Massachusetts* developed by Mass Audubon, Massachusetts Woodlands Institute, and Massachusetts Department of Conservation and Recreation (Ferris, 2016; Hagenbuch, 2011). Additional sources have been cited throughout.

Representation of Forest Age Classes

A landscape of predominantly mature forest punctuated by patches of young regenerating forest will provide a diversity of age classes for species with different habitat requirements.

While small patches of early successional habitat can provide wildlife benefits, such as quality stopover habitat for migratory songbirds during fall migration, patches at least 3 acres in size are needed to provide nesting habitat for declining species of shrubland nesting birds (Roberts & King, 2017). There is consensus among biologists in New England that land managers should aim for 10 percent of forest land to be in early successional stage. Currently, only about 3 percent of Rhode Island and the same percentage of the New England region as a whole can be considered early successional habitat in young forest or shrubland successional stage.[3] The long-term goal is to create a mosaic of successional stages across the landscape, while also allowing some forest to naturally mature to true old-growth conditions. A diversity of forest ages, combined with the presence of wetland complexes and riparian areas, will help support the Rhode Island Birder's Dozen and many other bird species in Rhode Island.

Amount of Forest Cover and Large Forest Blocks

Large swathes of contiguous forest (>250 acres) provide high quality habitat for interior nesting birds that reproduce more successfully away from edges and development. Forest-interior bird species avoid habitat edges and prefer the inner core of a forested block. The minimum size of a forest block needed to provide high-quality habitat depends on the amount of forest cover in the landscape. For example, Wood Thrush in a heavily forested landscape (>70% cover) can find high-quality habitat in medium-sized blocks of about 200 acres. In landscapes with little forest (40% cover), Wood Thrush needs blocks of more than 350 acres for good habitat (Rosenberg et al., 2003). Other species in the Rhode Island Birder's Dozen are sensitive to block size, including the Black-throated Green Warbler and Ovenbird. Many bird species are sensitive to habitat edges as well, which is a separate but related issue connected to the size and shape of forest blocks. Forest edge is discussed in the "Stand-Level Assessment" section.

Forest Fragmentation and Surrounding Land Use

The proximity of forest blocks to each other matters, especially in a fragmented landscape. A bird's reproductive success is often higher in a block located close to other forest. Dispersal movements can occur among forest blocks, where individuals from a growing population (especially young birds) can supplement a declining population, recolonize an area of forest where a local extinction occurred, or simply add genetic diversity to neighboring populations. Thus, large forest blocks in close proximity to one another are more valuable than small, isolated forested areas. The maximum distance for blocks of forest to still be considered close will vary by species. It is also important to consider land uses of the surrounding landscape. A bird will more readily move through a low-intensity residential area with scattered trees than an expansive parking lot.

Stand-Level Assessment

Moving further inward from the surrounding landscape, the last thing to consider is the habitat complexity and structure within a stand. This is the level at which management actions will be recommended in this guide. A stand is a usually homogenous area of trees of a particular cover

[3] Gary Casabona, State Biologist, Natural Resources Conservation Service, email communication, March 2019.

type, age class, or size class distribution and condition (DeGraaf et al., 2006). A bird's ability to survive and successfully reproduce is related to the presence of specific structural features such as nest sites, food and foraging substrates, singing perches, and cover from predators. The mere presence of a particular species does not necessarily indicate high-quality habitat.

Managing forest conditions to develop appropriate structural features can increase the habitat quality of a stand and make it more likely that a given species is not only present, but can also successfully survive and reproduce. Of course, not all birds require the same habitat conditions, and it is rarely possible to manage for all species in the same space. Be sure to consult the *Birder's Dozen Pocket Guide for Rhode Island Foresters* when making management decisions for each species or habitat type.

This section is organized around habitat attributes which are linked to habitat quality for one or more of the Rhode Island Birder's Dozen species. It explains the function of each habitat attribute and offers tips on how each might be measured if the measurement is not already captured in a standard forest stand inventory. There is no single right way to collect this habitat information. Each forester will have a system that integrates best with their own forest inventory protocol and is appropriate for the geographic location and stand condition (Town et al., 2018). The bird habitat information featured in this guide is primarily qualitative and descriptive. Although some attributes may include quantitative measures, they are not intended to provide numerical indices of habitat quality.

Forest Edge

Definition

Forest edge is created when mixtures of habitat elements produce boundaries between habitat types, successional stages, or plant communities. Forest edges can exist between mixtures of forest and non-forest habitat or between forest stands of different ages. Edges can support distinct wildlife communities that would not appear in completely forested or very open habitat, and birds like cardinals, indigo buntings, and song sparrows can thrive in the brushy edges between non-forest and forest communities (DeGraaf et al., 2006). However, birds nesting close to the forest edge face a higher abundance of nest predators and the brood-parasitizing Brown-headed Cowbird, especially in fragmented landscapes (Chalfoun et al. 2002 & Howell et al. 2007). These and other negative effects of edge can extend 150 to 300 feet into the forest interior and threaten birds that thrive in the forest core. Young forest birds are also sensitive to edge. Both early successional and mature forest birds (during the post-breeding period) have been found to prefer interior young forest habitat (at least 164 feet from the edge) compared to edge habitat.

Forest edge along an old field site, Exeter, RI. Credit: Marc Tremblay

Integration Tips

Foresters can promote healthy bird habitat by creating "soft edges" and minimizing the amount of forest edge. Create small square or circular patches of young forest rather than

rectangular or irregularly shaped patches to reduce the amount of edge. A long, thin strip of forest is the least desirable for birds and other edge-sensitive wildlife. Consider regenerating areas between peninsulas and indentations to improve the shape. Regeneration can also connect smaller patches to form one large forest area. Soft edges between mature and young forest openings, like edges lined with brushy shrubs or woody plants, are better than abrupt hard edges. Soft edges provide a buffer against predators and Brown-headed Cowbirds entering deeply into the forest, and obscure their view of nesting birds (Hagenbuch et al., 2012).

Understory Vegetation

Definition

Live vegetation in the 1-5 ft. height range, including tree seedlings and saplings, and shrubs.

Function for Forest Birds

High stem and foliage densities of woody plants in this forest layer provide potential nest sites, foraging substrates, and protective cover. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. Herbaceous plants may also be used by songbirds for foraging and nesting, but generally less so than woody plants. Species in this layer frequently used by birds include American beech, high and lowbush blueberry, red spruce, *Rubus* species, *Viburnum* species, sweet pepperbush, and spicebush. Ovenbird and Wood Thrush place nests in this layer.

Inventory Integration Tips

- When evaluating regeneration at a plot, simultaneously evaluate density of all vegetation in the understory layer – whether shrubs, commercial species, or non-commercial species.
- Note whether distribution is even or patchy at and between plots.
- When inventorying during leaf-off, evaluate foliar density by trying to visualize what it would look like during leaf-on when nesting occurs.

Midstory Vegetation

Definition

Live, woody vegetation in the 6 – 30 ft. height range including trees and shrubs.

Function for Forest Birds

High stem and foliage densities of woody plants in this forest layer provide potential nest sites, foraging substrates, and protective cover. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. Nests of Wood Thrush and Black-throated Green Warbler are most commonly found in the midstory level.

Inventory Integration Tips

- When evaluating commercial regeneration at a plot, simultaneously evaluate density of all vegetation in the midstory layer – whether shrubs, commercial species, or non-commercial species.
- Note whether distribution is even or patchy at and between plots.
- When inventorying during leaf-off, evaluate foliar density by trying to visualize what it would look like during leaf-on when nesting occurs.
- Coverage in 30-70 percent of this layer is desirable, although species will have different preferences.

Canopy Height

Function for Forest Birds

Canopy height influences nesting site potential for birds in both young, regenerating (early-successional) and mature (mid-late successional) forest habitat. For birds that nest in early-successional habitats – such as Chestnut-sided Warbler – once the regeneration attains a height

of approximately 20 feet, overall conditions are no longer suitable as nesting habitat. For mature forest nesting birds, including Wood Thrush, nest site selection is strongly associated with increasing canopy height.

Canopy Closure of Dominant and Co-Dominant Trees

Function for Forest Birds

Forest stands of at least one acre with an open canopy (less than 30% closure) are likely to provide early successional habitat conditions. An intermediate canopy (30 to 80% closure) often promotes advance regeneration and shrub development suitable for understory and midstory-nesting birds. Canopy closure tends to be inversely proportional to understory development.

For the purposes of forest bird habitat, a mature forest is greater than 30 feet high and has a generally closed canopy (greater than 80%) with relatively small gap openings throughout. This favors a suite of mature forest-nesting bird species, including Ovenbird and Black-throated Green Warbler.

Inventory Integration Tips

- Consider using three categories when describing canopy closure; open (less than 30%), intermediate (30 to 80%), and closed (greater than 80%).
- Describe canopy closure as observed within a 20 foot radius from prism plot center.
- Overall canopy closure description on a property is likely to be a mix of categories.

Coarse and Fine Woody Material

Definition

Coarse woody material (CWM) is downed logs and branches at least 5 inches in diameter at the tip and greater than 5 feet long. Fine woody material (FWM) is limbs and branches less than 4 inches in diameter, including slash. Blowdowns and slash are the most common sources of CWM and FWM.

Function for Forest Birds

CWM provides perch sites for singing (e.g. by Ovenbird) and other male courtship displays, and provides habitat for the insects and other arthropods that are a significant part of the breeding season diet of many birds. Ruffed grouse tend to use CWM greater than 8 inches in diameter as drumming perches. Individual pieces of FWM have little value, but when it is aggregated into piles (e.g., slash piles), it can offer perches, nesting substrate, and protective cover.

Inventory Integration Tips

- Maintain a minimum of at least two cords per acre of CWM. When possible, leave large cull logs that will remain for long periods of time.
- Note decay stage of CWM. Sound pieces provide greater habitat function than soft material.
- Note if fine woody debris is scattered or aggregated.

Leaving slash, Hopkinton, RI. Credit: Marc Tremblay

Snags and Cavity Trees

Definition

Snags are standing dead or partially dead trees that are relatively stable. Cavity trees are those with naturally formed hollows in the trunk or a branch. Cavity trees are generally old trees, and they may be alive or dead.

Function for Forest Birds

Snags provide opportunities for nesting cavity excavation by Pileated Woodpeckers and existing cavity trees provide potential nesting cavities for birds including Barred Owls. Aspen and birch species are frequently chosen by cavity excavating bird species as live trees to excavate. Cavities are often made in trees with the heartwood decay fungi *Phellinus tremulae* and *Fomes fomentarius* and sapwood decay fungi *Trichaptum biformis* and *Traemetes versicolor*. Suggested targets for snags and cavity trees combined are at least 6 per acre, with one tree greater than 18 inches DBH and three trees greater than 12 inches DBH. Branches on snags may be used as foraging perches and nest sites.

Inventory Integration Tips

- Include snags and cavity trees in tally at plot.
- Indicate whether trees are dead or alive and whether cavities are present.
- Qualitatively assess snag and cavity tree abundance between plots: low (overall low abundance of any snags or cavity trees), moderate (snags and cavity trees present, but of small diameter(s) or minimal abundance of snags and cavity trees of target diameters), and high (abundance of target diameter snags and cavity trees).
- Make special note of aspen and birch snags and cavity trees.

Deciduous Leaf Litter

Function for Forest Birds

An abundant layer of moist leaf litter is home to an array of insects, mites, and spiders. These arthropods make up a significant component of Ovenbird and Wood Thrush diets during the breeding season. Ovenbirds also rely upon a deep layer of deciduous litter for constructing their ground nests, and nest site selection is strongly associated with this habitat variable. For these reasons the period from early May-late July is the best time to assess litter conditions.

Inventory Integration Tips

- Assess leaf litter within a 5 ft. radius of plot center.
- Qualitative ranking of present or absent should be sufficient to assess function for birds.
- Leaf litter thickness varies with season; it is thickest in fall and may decompose over the following growing season until it is absent.

Deciduous leaf litter around water features, Foster, RI. Credit: Marc Tremblay

Soft Mast

Function for Forest Birds

Retain, release, and regenerate soft mast species such as black cherry, serviceberry, and apple. These produce food sources that are especially important in late summer when many species are

preparing for a strenuous migration and undergoing energy-intensive molt. *Rubus* species that dominate openings are also important sources of soft mast for birds. In young forests, and in the understory of mature forests, shrubs like *Viburnum* species, dogwoods, and blueberries are also desirable. Viburnum and Dogwood species have the highest nutritional value for migratory songbirds in the northeast (Smith & McWilliams, 2015).

Inventory Integration Tips

- Note presence of species within and between inventory plots.

Water Features

Function for Forest Birds

Water features like lakes, ponds, bogs, or rocky or gravelly-bottomed streams within a forest matrix support many wildlife species. The Northern Waterthrush breeds in thickets near water features, including streams, ponds, swamps, and bogs (Cornell Lab of Ornithology, 2017).

Inventory Integration Tips

- Note presence within and between inventory plot

V. Making Management Decisions

Foresters should consult with landowners in order to ensure that the landowner's goals and objectives are always considered before creating a management plan. Foresters should ask themselves the following questions before making their management decisions with birds in mind:

- What are the bird habitat strengths and deficiencies across the ecoregion, landscape, and property?
- What birds are presently benefiting? What birds could or should be here?
- Is there unique habitat on the property? In the landscape? A stark lack of certain habitat, like protected forest blocks or young forest patches?
- Are there opportunities to leverage existing quality habitat to improve nearby deficiencies?
- Are there timber management priorities that can be used to leverage habitat creation, or that can be adjusted to maintain habitat elements?
- Does the habitat need to be enhanced? "Let it grow" may be the most appropriate action.

Considering these and other questions can help identify areas of important habitat, prioritize stands for treatment, or help justify a complex management decision. All decisions involve a balancing act between habitat ideals and landowner objectives, so assigning value to particular habitat elements based on the assessment and the landowner's priorities is a critical consideration.

Every silvicultural application will have its pros and cons for a given bird or related group of birds. For practical purposes, the effects of management can be generalized into the following three categories of harvest intensity, each of which typically creates a forest condition that will benefit slightly different suites of birds. This content may be used to help select a harvest intensity to create specific habitat, or it may be used to identify the resulting habitat attributes likely to be created by a proposed harvest.

Management Option 0: Let It Grow

When supported by current stand conditions, appropriate landscape context, and a landowner's objectives, "let it grow" can sometimes be the best option to promote bird habitat. Closed-canopied stands with well-developed midstory and understory layers – perhaps as the result of past management practices – are likely already providing quality forest bird habitat and will continue to function without a harvest. Letting it grow should not, however, mean "do nothing." In the absence of an impending timber harvest, there are many less intensive management activities that can serve to maintain or enhance the habitat quality currently provided by the stand, such as:

- Creating snags and future cavity trees throughout stands by girdling;
- Increasing coarse and fine woody material on the forest floor;
- Controlling invasive plant populations;
- Supplemental planting of mast-producing shrubs; and
- Identifying legacy or wolf trees (e.g., trees with especially large size, cavities, shaggy bark, etc.).

Management Option 1: Low-Intensity Harvest

A low-intensity harvest maintains a closed-canopied forest (>80% closure) while enhancing timber quality of existing stems. Understory and midstory layers may also be enhanced, favoring shade-tolerant tree species and understory plants. These types of harvests are meant to mimic small and infrequent natural disturbances, like wind-throw or ice storm damage, which create small scattered gaps in the canopy and increase growing space for residual crowns. Natural events would create snags and woody material, so these are appropriate considerations during harvest as well.

The decision to conduct a low-intensity harvest may represent a balance between managing for timber and mature forest habitat. Periodic harvests may occur while maintaining and gradually enhancing the habitat quality. These types of treatments favor birds that require mature, closed-canopied forests for breeding, such as Black-throated Green Warbler, Eastern Wood-pewee and Wood Thrush. Other important elements to consider are understory and midstory layers, snags, woody debris, and the softwood component.

MANAGEMENT OPTION 1

Attribute Enhancement

- Locate gaps to release advance regeneration, remove clusters of high-risk, low-vigor, or low-value trees, and avoid sensitive sites
- Expand crop tree definition to include:
    - Tree species with special bird value (e.g. soft mast)
    - Trees with novel features (e.g. cavities or large crowns for perching)
    - Underrepresented species (e.g., soft mast producers, softwood inclusions)
- Maintain or enhance an understory tree and shrub component for forage and cover
- Retain cavity and den trees
- Increase coarse and fine woody material on the forest floor

Compatible Silvicultural Treatments

- Small Group (<0.3 ac) and Single Tree Selection
- Variable Retention Thinning
- Crop tree release with gap formation
- Patch Selection
- Mixed Intermediate Treatments

Management Option 2:

Moderate Intensity Harvest

When managing for birds, the moderate-intensity harvest category encompasses a broad range of silvicultural practices, all of which generally involve a regeneration event and a deliberate canopy retention somewhere between 30 to 80 percent. Specific retention and regeneration systems will vary based on timber quality, markets, overstory species, regeneration target species, and myriad other factors. In terms of bird habitat, what these treatments all share is a marked increase in understory vegetation and widespread creation of gaps and openings of various sizes. This type of harvest may mimic a range of natural events to which birds have adapted, including widespread tree mortality due to pests or pathogens, which would create a significant number of snags and woody debris over time.

Depending on canopy retention and opening sizes, these types of treatments will benefit different birds. At the higher end of canopy retention, benefits may be kept intact for birds requiring closed-canopy forests for breeding, such as Black-Throated Green Warbler and Wood Thrush, and may in fact create optimal habitat for gap feeders like Eastern Wood-pewee. At the lower end of canopy retention, or with removals focused in larger groups or patches, birds that depend on young forest will likely start to appear.

MANAGEMENT OPTION 2

Attribute Enhancement

- Locate gaps **and patches** to release advance regeneration, remove clusters of high-risk, low-vigor, or low-value trees, and avoid sensitive sites
- Expand crop tree definition to include:
    - Tree species with special bird value
    - (e.g., soft mast)
    - Trees with novel features (e.g., cavities or large crowns for perching)
    - Underrepresented species (e.g., soft mast producers, softwood inclusions)
- Maintain or enhance an understory tree and shrub component for forage and cover
- Retain cavity and den trees
- Increase coarse and fine woody material on the forest floor

Compatible Silvicultural Treatments

- Small Group (0.5 – 0.75 ac) Selection
- Shelterwood with Reserves
- Expanding Gap Shelterwood
- Patch Selection

Bird-Friendly Best Management Practices

There are Bird-friendly Best Management Practices (BBMPs) that may be implemented during any timber harvest that will benefit forest-breeding birds:

Time of Year: All harvesting should occur between November 1 and March 1 when possible. Operate outside of the breeding season (mid-April to late August in Rhode Island), as to not disrupt mating behavior, destroy nests, or alter quality habitat after birds have chosen their territories. Waiting until November for harvest has the added benefit of protecting declining species of turtle which go into hibernation around November 1st in Rhode Island.[4] If projects are being funded by the Natural Resources Conservation Service, harvesting is prohibited in June and July because of the long-eared bat. In Glocester, you can only harvest between November 1 and March 1 because of small whorled pogonia plant.

Roads and Trails: Keep woods roads and skid trails less than 15 feet wide, and incorporate bends and twists on long straightaways. Wider roads have been shown to have a fragmentation effect to interior forest species, such as the Wood Thrush and Ovenbird, and long stretches of straight roads are favorable corridors for Brown-headed Cowbird to travel into forest interiors.

Messy is good: Avoid a park-like condition; leave some tops, slash, and coarse woody material that can be used as cover, singing perches, and foraging substrates.

Follow normal Best Management Practices: A number of bird species rely on forested swamps and other wetland habitat such as stream banks for breeding. Following basic Forestry Best Management Practices that protect wetlands will help these birds. Avoid disturbing existing tip-ups, stumps, and logs and snags during harvesting operations.

[4] Gary Casabona, State Biologist, Natural Resources Conservation Service, personal communication, January 2019.

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Appendix: Forestry for Rhode Island Birds Glossary

Appendix: Forestry for Rhode Island Birds Project Glossary

Age Class
One of the intervals into which the age range of trees is divided for classification or use; a distinct cohort of trees originating from a single natural event or regeneration activity.[1]

Canopy
The uppermost layer in a forest, formed collectively by tree crowns.[2]

Crop Tree
Any tree selected to become a component of a future commercial harvest.[3]

Crop Tree Release
A silvicultural treatment designed to free young trees from undesirable competing vegetation.

Crop Tree Release with Gap Formation
A treatment designed to free young trees from undesirable competing vegetation and create openings in the forest canopy.

Crown
The living branches and foliage of a tree.[4]

Crown Class
A relative designation of tree crowns, broken into distinct layers.[5]

Dominant
Trees much taller than the general level of the canopy, receiving direct sunlight on all sides of their crown.

Co-Dominant
Trees that form the general level of the *canopy*, but below the dominants, receiving sunlight from above their *crown* and some from the side.

Intermediate
Trees with *crowns* that fall below the general level of the *canopy*, receiving sunlight only from above at midday.

Suppressed
Trees much shorter than the general level of the *canopy*, receiving only filtered sunlight.

Early Successional Habitat
Habitat with vigorously growing grasses, forbs, shrubs and trees which provide excellent food and cover for wildlife but need disturbance to be maintained. Such habitats include weedy areas, grasslands, old fields or pastures, shrub thickets, and recently cut young forest.[6]

Even-aged Method
A silvicultural practice of regenerating and maintaining a single age class of trees in a forest stand. These methods include:

Shelterwood
An even-aged method referring to the cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment. Note the sequence of treatments can include three types of cuttings: (a) an optional preparatory cut to enhance conditions for seed production, (b) an establishment cut to prepare the seed bed and to create a new age class, and (c) a removal cut to release established regeneration from competition with the overwood. Cutting may be done uniformly throughout the stand (uniform shelterwood), in groups or patches (group shelterwood), or in strips (strip shelterwood).[7]

Expanding Gap Shelterwood
An even-aged, hybrid technique that functions somewhere between a group selection and a traditional shelterwood. Trees are cut in small

groups, with the cuts expanding across the target forest stand over a series of 3 to 8 harvests. One harvest should occur every 5 to 15 years to create expanding gaps in the canopy. Using a series of cuts, initial gaps are expanded through successive harvests until their borders join to create larger, continuous openings.[8]

Clearcutting
The cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class.[9]

Seed Tree
The cutting of all trees except for a small number of widely dispersed trees retained for seed production and to produce a new age class in a fully exposed microenvironment.[10]

Forested Wetland
Forested wetlands refer to areas where tree species dominate an area in which water covers the soil or is near the surface of the soil for varying periods of time during the year. These areas are also referred to as swamps or wooded wetlands. About 11 percent of Rhode Island's landscape consists of freshwater wetlands and most of this land area (48,182 acres total) consists of forested wetlands dominated by red maple. The vast majority of wetlands in the state are privately owned. Forested wetlands include Atlantic white cedar swamp and red maple-ash swamp natural communities. Forested wetland communities provide important breeding habitat to numerous birds in Rhode Island, like the Northern Waterthrush. Among these attributes are low average canopy height and abundance of ground cover, primarily ferns and shrubs. Structurally complex forest floors with hummocks, rootballs, and downed woody debris provide concealment for nests and young.[11]

Gap Formation
Spaces in the tree canopy of a forest stand that are created due to individual or group tree harvest, blowdown, or mortality.[12]

Habitat
The place, natural or otherwise, (including climate, food, cover, and water) where an animal, plant, or population naturally or normally lives and develops.[13]

Hardwood/Softwood Mix
Mixed hardwood and softwood forest refers to areas where neither hardwood tree species nor softwood species make up more than 80 percent of the forested area. Areas of mixed hardwood and softwood composition are important to bird species that breed in Rhode Island, including the priority bird species of Pileated Woodpecker, Barred Owl, and Rose-breasted Grosbeak. Mixed hardwood and softwood forest communities include oak-pine, eastern hemlock-hardwood forest, and hemlock.[14]

Intermediate Treatments
Cutting (or eliminating) immature trees between the stages of stand establishment and final stand harvest, to improve the quality of or reduce competition among the remaining trees. In contrast to a regeneration cut, an intermediate cut may or may not generate income.[15] These include:

Stand Improvement
An intermediate treatment conducted to improve the composition, structure, condition, health and growth of even- or uneven- aged stands.

Legacy Tree
A tree, usually mature or old-growth, that is retained on a site after harvesting or natural disturbance to provide an organism from a previous ecosystem that can structurally enrich the new stand.[16]

Appendix: Forestry for Rhode Island Birds Project Glossary

Mature Hardwood
Mature hardwood forest refers to areas where mid- to late- successional deciduous hardwood tree species dominate tree composition of the landscape (compose more than 80 percent of the forested area). Hardwood species that occur in Rhode Island include scarlet, white, red, and black oak, red maple, black gum, beech, birch, and aspen. Areas of mature hardwood are important to bird species that breed in Rhode Island, including these priority bird species: Scarlet Tanager, Wood Thrush, Black-and-white Warbler, Eastern Wood-pewee, Red-eyed Vireo, and Ovenbird. Hardwood forest natural communities include oak-hickory, oak-pine, maple-beech-birch, oak-gum-cypress, and aspen-birch.[17]

Mature Softwood
Mature softwood forest refers to areas where late successional coniferous tree species dominate tree composition of the landscape (compose more than 80 percent of the forested area). Softwood species that occur in Rhode Island include white pine, red pine, pitch pine, spruce, and hemlock. Areas of mature softwood are important to bird species that breed in Rhode Island, including the priority bird species of Pine Warbler and Black-throated Green Warbler. Softwood natural communities include pine-oak, hemlock, and pitch pine.[18]

Mesic
Sites or habitats characterized by intermediate moisture conditions; neither decidedly wet nor dry.[19]

Midstory
The layer of vegetation existing between the smallest (understory) and tallest (overstory) plants, normally trees, in a forest.[20]

Old-Growth Forest
The late successional stage of forest development. Old-growth forests are defined in many ways; generally structural characteristics used to describe old-growth forests include: live trees, canopy conditions, snags, and down logs and coarse woody debris. Stand age, although a useful indicator of old growth, is often considered less important than structure. Due to large differences in forest types, climate, site quality, and natural disturbance history, old growth forests vary extensively in tree size, age classes, presence and abundance of structural elements, presence of understory, and stability.[21]

Overstory
That portion of trees, in a forest of more than one story, forming the upper-most canopy layer.[22]

Patch
1. A small part of a stand or forest; 2. An ecosystem element (e.g. an area of vegetation) that is relatively homogenous internally and differs from surrounding elements.[23]

Patch selection
An even-aged method of cutting all trees in a patch to produce a fully exposed microclimate for the development of a new age class.[24]

Regeneration
The act of renewing tree cover by establishing young trees naturally or artificially. Regeneration usually maintains the same forest type.

> ***Advance Regeneration***
> Seedlings or saplings that develop or are present in the understory.[25]

Regeneration Method
A cutting procedure by which a new age class is created. Regeneration methods are grouped into four categories: coppice, even-aged, two-aged, and uneven-aged. (Not all terms are defined in this glossary – see *The Dictionary of Forestry* for more information).[26]

Retention
To leave selected trees uncut during a harvest.[27]

Rubus
Any of a genus (*Rubus*) of plants (such as a blackberry or a raspberry) of the rose family with leaves that typically have three to seven leaflets or that are simple and lobed, white or pink flowers, usually prickly stems, and a mass of carpels ripening into an aggregate fruit composed of many drupelets.[28]

Sawtimber
Trees or logs cut from trees with minimum diameter and length and with stem quality suitable for conversion to lumber.[29]

Second-growth forest
A relatively young forest that has been regenerated naturally or artificially after some drastic interference such as extensive cutting, wildlife, insect or disease attack, or blowdown.[30]

Size class
A relative designation of trees based on their size at DBH (DBH stands for diameter at breast height, the outside-of-the-bark diameter of a tree 4.5 feet above the ground, measured on the uphill side of the tree).[31]

Seedling
A tree, usually less than an inch in diameter, and no more than 3 feet in height, that has grown from seed (in contrast to a sprout).

Sapling
A small tree, usually between 1 and 3 inches DBH and 15 to 30 feet in height.

Poles
A tree generally 3 to 12 inches DBH.

Sawtimber
A tree greater than 12 inches DBH that can be sawn for lumber.

Slash
Nonmerchantable residue left on the ground after logging, thinning, or other forest operations involving cutting trees. Includes tree tops, broken branches, uprooted stumps, defective logs and bark. Slash can have certain ecological benefits, such as adding nutrients to the soil or providing wildlife habitat.[32]

Snag
A standing dead tree, generally considered nonmerchantable, without leaves and finer limbs, that is retained in a forest for wildlife and/or aesthetic values.[33]

Soft Mast
Soft tree fruits, like persimmon and cherry.[34]

Stand
A recognizable area of a forest that is relatively similar in species composition or physical characteristics and can be managed as a single unit. Stands are the basic management units of a forest.[35]

Territory
The area that an animal defends, usually during breeding season, against intruders of its own species.[36]

Two-aged Methods
A silvicultural practice of regenerating and maintaining stands with two age classes. These include:

Shelterwood with Reserves
Some or all of the reserve trees are retained after regenerating species have become established to attain goals other than regeneration.

Thinning
Tree removal in an immature forest stand that reduces tree density and between-tree competition. Proper thinning encourages increased growth of fewer but higher quality trees.[37]

Understory
That portion of the trees or other vegetation existing below the midstory and canopy in a forest.[38]

Un-even aged (selection) methods
A silvicultural practice of regenerating and maintaining a multiaged structure by removing some trees in all size classes either singly, in small groups, or in strips. These include:[39]

Group Selection
An uneven-aged method in which trees are removed and new age classes are established in small groups.

Group Selection with Reserves
Some trees within the group are not cut to attain goals other than regeneration within the group.

Single Tree Selection
Individual trees of typically large size classes are removed more or less uniformly throughout the stand, to promote the growth of remaining trees and to provide space for regeneration.

Variable Retention Thinning
An approach to thinning based on the retention of structural elements or biological legacies (trees, snags, logs, etc.) from the thinned stand for integration into the new stand to achieve various ecological objectives.[40] The result has an irregular or patchy appearance.

Viburnum
Viburnums are part of a large and diverse group of evergreen and deciduous plants grown as small trees and shrubs. Their leaves often look similar to maple. They are often identified with large fragrant flower clusters and brilliantly colored fruits. Deciduous types are generally grown for their flowers and evergreen types are grown for their lovely foliage. They are useful as hedges, screens, specimen small trees, or specimen flowering shrubs.[41]

Wolf Tree
A living tree that is usually older, larger or with more branches than other trees in the stand.[42] In New England, these trees are often found along stone walls or other boundaries and first grew in open conditions, predating the other younger trees in the stand.[43]

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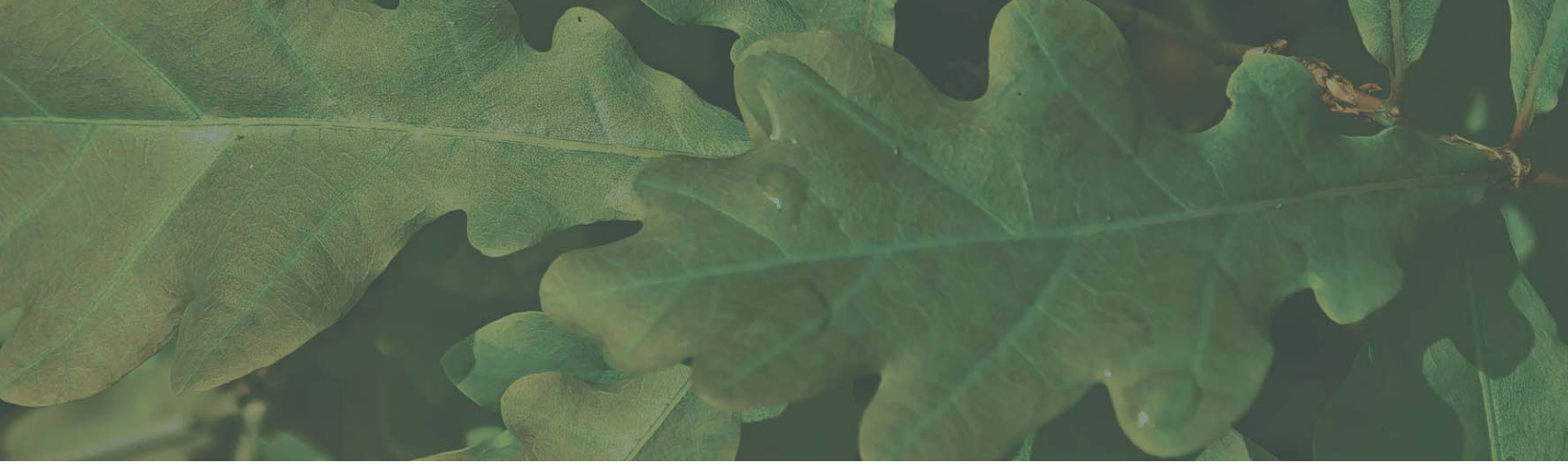

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