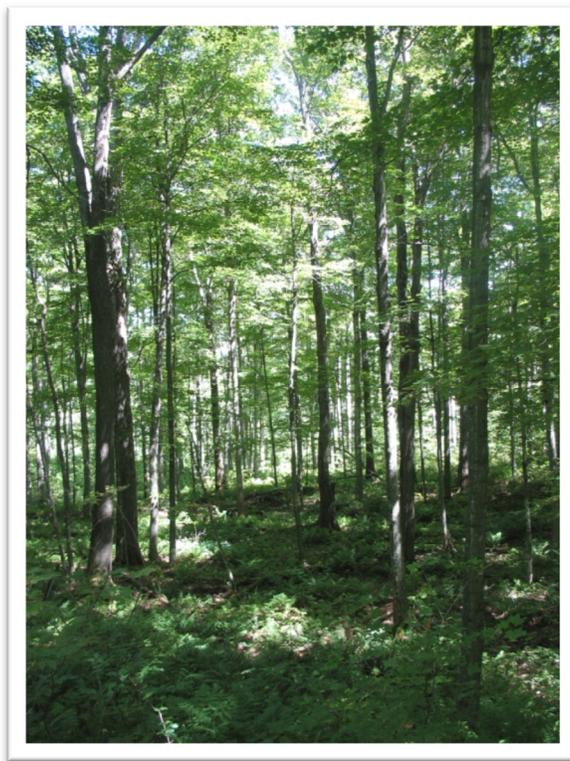


Forest Bird Habitat Assessment



Properties of:

Town of Berlin, VT

(Lawson Lot, Dufresne Lot, Ridgeline Lot, Town Forest)

Located in:

Berlin, VT

Prepared by: Steve Hagenbuch

Conservation Biologist

shagenbuch@audubon.org

January 25, 2012

Property Information

Landowner's Name: Town of Berlin, VT

Town: Berlin, VT

Priority Block: N/A

Acres: 715

Assessment Date: August 26, 2011

Forest Management Plan: yes, various dates for separate parcels. Plan for Town Forest updated in 2011

Forester: Beth Daut

Landowner Objectives: Per Irish Hill Management Plan (2007) pertaining to Ridgeline and Laswon Lot: to conserve forestry values, wildlife habitats, biological diversity, natural communities, riparian buffers, aquatic habitats, wetlands, soil productivity, water quality and natural flora and fauna, and the ecological processes that sustain these natural resources values.

Introduction

Breeding bird surveys have shown that the forests of Vermont and Northern New England are globally important for birds throughout the hemisphere. **Our forests are home to the highest concentration of bird species breeding in the continental United States;** they are a "veritable breeding factory" for hundreds of neo-tropical migratory birds.

Unfortunately – even though they are still common in our area - **many of these birds are experiencing long-term population declines.** Audubon Vermont's Forest Bird Initiative focuses its conservation efforts on 40 of these forest bird species, known as *responsibility species* (Appendix 1). These birds have a high proportion of their global populations breeding in our region, so we have the responsibility – and opportunity - to keep them common before they become threatened or endangered.

Since roughly 80% of our region's forests are privately-owned, even the smallest properties can be critical parts of large forest blocks that provide high-quality habitat for breeding birds. **Small actions by individual forest landowners can have a global impact.** Audubon Vermont is partnering with foresters and other stewardship and conservation organizations to provide technical assistance to and educational opportunities for landowners who want to make a difference for birds in their forests. Habitat assessments and reports are provided to landowners free of charge due to generous support from grant funding and individual donations.



Meet some of the responsibility species that may be nesting your forest (left to right): chestnut-sided warbler, Canada warbler, scarlet tanager, Blackburnian warbler.

How to use this report

This assessment was conducted by an Audubon biologist in order to (1) describe current forest bird habitat conditions on the property, (2) identify specific opportunities for protecting and/or enhancing habitat, and (3) suggest management options and/or considerations for improving bird habitat over a 10 year period. Here are some suggestions for what to do with this report after you look it over:

Learn more about birds and habitat on the property(s). Whether you are a seasoned birder or only recognize a couple of songs, we hope that this report will show you something new about your property and leave you wanting to learn more. You can add to the information about birds on your land by learning to identify the *Birder's Dozen* if you don't know them already and noting when and where you hear birds in your woods. If you are interested in doing some simple monitoring on your property, let us know and we can help get you started. We'll also keep you posted about workshops and other learning opportunities at the Green Mountain Audubon Center in Huntington, Vermont or elsewhere in the region.

Share and discuss this report with your forester. Tell your consulting and/or county forester that birds are important to you and that you want to prioritize protection of their habitat on your property. Ask your forester if s/he is already working with Audubon through the *Foresters for the Birds* project. If not, suggest that s/he join.

Include information and recommendations in this report in your forest management plan or attach the report as an appendix. This report is designed to supplement and inform a full forest management plan created by your forester in order to maximize positive impacts on breeding forest birds. If you request it, we hope that much of the information in this report could easily be inserted into a new plan or update.

List protection and enhancement of forest bird habit as a management objective in your forest management plan. Make your interest in birds clear and state it right up front. Example: *Protect and enhance habitat for breeding birds of conservation concern.*

Share this report with other town committees and boards as well as neighboring landowners. You can help spread the word about the importance of our forests for responsibility species and let others know about the services that Audubon provides for landowners interested in making a difference for birds on their properties. When landowners keep in touch about planning management activities across property boundaries they can maximize the benefits of their actions for birds and forest health.

Contact us and/or your county forester with any questions or when you're planning management activities. We'll be happy to follow up with you and provide additional assistance if and when you implement any of our recommendations.

Landscape Context

The Berlin Town lands comprise a major component of the mature interior forest on a ridgeline flanked to the east and west by valleys containing more open/developed land and associated road networks. Young forest, or early-successional, conditions occur but at a lower threshold (3-5% of the 2,500 acre landscape) than deemed necessary to support viable populations of associated bird species. Wetlands, streams, and lakes/ponds are also a valuable habitat component on the landscape. Although fairly extensive the non-forested areas are not likely to impart negative fragmentation effects on forest birds utilizing the Berlin Town lands (Map 1).

The landscape context lends itself to further promoting and/or maintaining structurally complex mature forest on the Berlin Town lands while developing a component of early-successional habitat conditions (young forest and/or old field).

An impressive aspect of the landscape is the abundance of conserved land which includes much of the Berlin Town land. The long-term nature of conservation easements helps to ensure that the majority of the interior forest that makes up the ridgeline will remain un-fragmented well into the future.

Property Descriptions

In their current condition the Berlin Town lands primarily provide breeding habitat for bird species that nest and forage in closed canopy, mature, interior forest. Variation in forest structure and composition among the four lots does make some areas, such as the Town Forest, higher quality habitat conducive to a greater number of bird species. Of special note on the Town Forest is the documented occurrence of the rare plant, male fern (*Dryopteris filix-mas*). For additional information contact Everett Marshall at the VT Natural Heritage Program (802-241-3715). The Ridgeline lot, which is still in the early stages of regrowth from the heavy 1997 harvest, is of lower quality habitat and likely to support a less diverse bird community. The Dufresne and Lawson lots fall somewhere in the middle in terms of forest bird habitat quality and provide some of the greatest opportunity for habitat enhancement through active management. The only other significantly different habitat condition is the old field on the Lawson lot.

An extremely valuable aspect of the property is the significant amount of interior forest, or forest condition that occurs with increasing distance from a forest edge. The ±715 acres that comprise this ownership is significant in its own right but the fact that this acreage is not fragmented by roads or development tremendously increases the property's bird habitat value. A number of forest nesting songbird species, including ovenbird, Blackburnian warbler, and black-throated blue warbler have been shown to increase in both abundance and nesting success as the area of forest away from a forest/non-forest edge, termed interior forest, increases.

Habitat Units

Summary of Habitat Units

Habitat Unit	Habitat Type	Stand(s)	Approx. Acres	% of Ownership	Description and Notes
1a	Mature Forest	Lawson and Dufresne Lots	175	24%	Mix of forest types including northern hardwood, hardwood/hemlock, and white pine
1b	Mature Forest	Ridgeline Lot	371	52%	Northern hardwoods and small section of mixedwood; Large-scale clearcut in 1997
1c	Mature Forest	Town Forest	168	23%	Nice quality hardwoods; good structural complexity in some areas
2	Open	Lawson Lot	2	<1%	Maintained herbaceous opening with apple trees

Habitat Unit 1a: Mature Forest - 175 acres

Current Habitat Conditions

Overall the mature forests of this habitat unit are comprised of pole and small sawtimber sized trees, maintain a high (>60 ft) closed canopy (>80% cover), are even-aged, and exhibit varying levels of structural complexity. Understory (0-5 ft) and midstory (6-30 ft) layers are generally lacking although there are patches where these features are well-developed. The latter condition is desirable and these areas have the ability to support a greater diversity of bird species than structurally simple areas. Bird species potentially benefitting from greater vertical structure include *black-throated blue warbler*(understory), *wood thrush*(midstory), and *scarlet tanager*(canopy).

Large diameter snags and both coarse (> 4 in diameter) and fine (<4 in diameter) woody material exist but are found in lower than desirable abundance. These may reduce habitat quality for *yellow-bellied sapsucker*, *white-throated sparrow*, and *ruffed grouse*. There is good future potential for cavity trees as the health of the paper birch and aspen component declines. Both of these tree species are heavily utilized as sites for excavation.

The diversity of tree species is desirable in that it has the potential to increase overall habitat suitability for a wider range of bird species. Birds such as *ovenbird*, *eastern wood-pewee*, and *American redstart* show a preference for hardwoods while *black-throated green warbler*, *blue-headed vireo*, and *blackburnian warbler* are more strongly associated with mixed and/or softwood dominated stands.

Non-native, invasive honeysuckle spp. have been noted in this habitat unit. Although some bird species are known to nest in and feed on berries of invasive plants they are of lower quality and not actually beneficial.

This habitat unit offers some of the best opportunities to enhance structure of mature forest as well as develop an area(s) of early-successional habitat conditions.



Structurally simple stand = lower habitat quality



Well-developed understory and midstory layers = higher habitat quality

Desired Habitat Conditions – Mature Forest (Primary)

Desired Condition	Potentially Benefiting Bird Species
Closed canopy conditions or at least 80% cover on average.	Ovenbird Black-throated green warbler Eastern wood-pewee Blue-headed vireo Blackburnian warbler
Interior forest conditions	Scarlet tanager Black-throated green warbler Wood thrush Veery Ovenbird Canada Warbler Northern parula Blue-headed vireo Blackburnian warbler
Enhanced understory and midstory vegetation layers	Black-throated blue warbler Veery Canada warbler Magnolia warbler White-throated sparrow Wood thrush American redstart Black-throated green warbler Blue-headed vireo
Large aspen and paper birch trees are retained, especially when declining, as potential cavity trees.	Northern flicker Yellow-bellied sapsucker
Large-diameter snags and cavity trees	Northern flicker Yellow-bellied sapsucker
Large logs on the ground	Ruffed grouse Canada warbler Ovenbird
Fine woody material is present and aggregated into piles.	Veery White-throated sparrow
Tree species diversity	All birds/general forest health
Invasive plants monitored and controlled	All birds/general forest health
Deep layer of moist deciduous leaf litter	Ovenbird, wood thrush, veery

Desired Habitat Conditions – Early-Successional (Secondary)

Desired Condition	Potentially Benefiting Bird Species *denotes species observed
Open canopy conditions (<30%) with high densities of regenerating seedlings, saplings, and shrubs	Chestnut-sided warbler Mourning warbler Nashville warbler Ruffed grouse American woodcock White-throated sparrow
Presence of soft mast producing trees and shrubs (e.g. raspberry, blackberry, cherry spp., elderberry, etc.)	Ovenbird American redstart Eastern wood-pewee Scarlet tanager Wood thrush Veery
Tree species diversity	All birds/general forest health
Invasive plants monitored and controlled	All birds/general forest health

****Special Note** – if the development of early-successional conditions is desired by the Town of Berlin it is recommended to create this condition on 2-5 acres ($\leq 5\%$) of the habitat unit.

Management Options and Considerations

A variety of silvicultural treatments could be used to achieve the desired habitat conditions described in the previous sections. The following options are from *Silviculture with Birds in Mind: Options for Integrating Timber and Songbird Habitat Management in Northern Hardwood Stands in Vermont* (Appendix 4).

Mature Forest

Option 1A – Crop Tree Release with Canopy Gap Formation

Option 1B – Variable-Retention Thinning

Option 2A – Expanding-Gap Group Shelterwood

Option 2B – Small Group and Single-Tree Selection – groups $\leq \frac{1}{2}$ acre preferable

Option 3B – Mixed Intermediate Treatments

Early-Successional

Option 2B – Small Group and Single-Tree Selection – groups > 1 acre preferable

Option 3A – Shelterwood with Reserves

Additional Management Considerations

Retain yellow birch - The branches and foliage of yellow birch are preferentially chosen foraging substrates for insect eating responsibility bird species, including blackburnian warbler, black-throated green warbler, and scarlet tanager. This preference may be due to higher densities of potential prey and the ability of these bird species to forage effectively among the branching and foliage structure of this tree species. Retain as many individuals, across all size classes, as possible.

Minimize harvesting during the bird breeding season - The forest bird breeding season roughly extends from May-August with the most critical time period running through the second or third week of July. Although it may not be desirable or possible to refrain from harvesting during this time frame, consider less intensive silviculture such as single-tree and small group selection. Shelterwoods and patch cut harvests during the breeding season are likely to have greater impact on bird communities. Harvesting during frozen ground conditions is preferable as it has no direct negative impact on the breeding bird community. Winter harvesting can also help protect advanced regeneration and understory shrubs from damage.

Minimize extent of forest access roads - Forest access roads can serve as pathways for increased nest predation and parasitism, particularly in forests within an agricultural matrix. Maintain < 15 percent of a property in roads and access trails and utilize the current trail system as much as possible. Minimize long, straight stretches of access roads into the forest interior. Road/trail widths <20 ft. are preferred. Wider forest roads may decrease habitat quality for ground foraging bird species such as ovenbird along the road edge due to decreases in leaf litter moisture, increased leaf litter temperature, and subsequent lowered densities of leaf litter arthropods. Densities of birds and reproductive success may be affected.

Habitat Unit 1b: Mature Forest - 371 acres

Current Habitat Conditions

This habitat unit is described as mature forest although it is a long way from having any abundance of older or larger trees. This classification is used more for the bird species that are likely to be currently using the forest than the age of the forest.

The forest of this habitat unit is comprised primarily of saplings with some poles and scattered small sawtimber sized trees. The average canopy height is intermediate (30-60 ft) and closed (>80% cover). Structural complexity is overall extremely low. These are expected conditions given the heavy harvesting that occurred over much of the unit in the mid-90's.

Due to little if any understory or midstory layers, large diameter snags and cavity trees, and coarse and fine woody material this habitat unit provides some of the lowest habitat quality on the town owned land. There are a few responsibility bird species that are likely to nest here however including *ovenbird* and *American redstart* but overall diversity will be low. As the forest matures overall conditions will become more favorable to support a greater number of bird species.

A valuable aspect of this habitat unit is the large amount of interior forest it provides. There is great potential for high-quality bird habitat in the future but probably not for at least the next 30 years. There are also currently at least a couple of beneficial fruit producing shrubs here; elderberry and dogwood spp. Many species of birds will feed on these fruits.



Common conditions throughout habitat unit



More of the same

Desired Habitat Conditions

Desired Condition	Potentially Benefiting Bird Species
Closed canopy conditions or at least 80% cover on average.	Ovenbird Black-throated green warbler Eastern wood-pewee Blue-headed vireo Blackburnian warbler
Interior forest conditions	Scarlet tanager Black-throated green warbler Wood thrush Veery Ovenbird Canada Warbler Northern parula Blue-headed vireo Blackburnian warbler
Enhanced understory and midstory vegetation layers	Black-throated blue warbler Veery Canada warbler Magnolia warbler White-throated sparrow Wood thrush American redstart Black-throated green warbler Blue-headed vireo
Large-diameter snags and cavity trees	Northern flicker Yellow-bellied sapsucker
Large logs on the ground	Ruffed grouse Canada warbler Ovenbird
Fine woody material is present and aggregated into piles.	Veery White-throated sparrow
Tree species diversity	All birds/general forest health
Invasive plants monitored and controlled	All birds/general forest health
Deep layer of moist deciduous leaf litter	Ovenbird, wood thrush, veery

Management Options and Considerations

Due to recent harvesting history no active management is recommended for this habitat unit during the 10 year cycle covered by this report. The desired conditions described above are long-term objectives and most will take many years to develop.

Habitat Unit 1c: Mature Forest - 168 acres

Current Habitat Conditions

Overall the mature forests of this habitat unit are comprised of pole and small sawtimber sized trees, maintain a high (>60 ft) closed canopy (>80% cover), and exhibit greater structural complexity than anywhere else on the town owned lands. Understory (0-5 ft) and midstory (6-30 ft) layers are moderately well-developed with the exception of near the northern boundary. Bird species potentially benefitting from greater vertical structure include *black-throated blue warbler*(understory), *wood thrush*(midstory), and *scarlet tanager*(canopy).

Large diameter snags and cavity trees do exist but are not evenly distributed. This should make portions of the unit well suited to cavity nesting species such as *yellow-bellied sapsucker*. Both coarse (> 4 in diameter) and fine (<4 in diameter) woody material are found in lower than desirable abundances. This may reduce habitat quality for *white-throated sparrow* and *ruffed grouse*.

The predominance of hardwoods in this unit makes it higher quality nesting and foraging habitat for *ovenbird*, *eastern wood-pewee* (*observed during the field visit*), *black-throated blue warbler*, *wood thrush* and *scarlet tanager* but limits usage by softwood preferring species including *blackburnian warbler* and *blue-headed vireo*.

Non-native, invasive buckthorn spp. is fairly abundant in this habitat unit. Although some bird species are known to nest in and feed on berries of invasive plants they are of lower quality and not actually beneficial.

Of special ecological note is the occurrence of a stand of butternut and the rare plant, male fern (*Dryopteris filix-mas*).

This habitat unit offers some of the best opportunities to enhance structure for mature forest bird species while simultaneously managing for high quality hardwood timber.



Complex structure is common in this habitat unit



This unit offers some of the best nesting habitat on the town owned

Desired Habitat Conditions

Desired Condition	Potentially Benefiting Bird Species
Closed canopy conditions or at least 80% cover on average.	Ovenbird Black-throated green warbler Eastern wood-pewee
Interior forest conditions	Scarlet tanager Black-throated green warbler Wood thrush Veery Ovenbird Canada Warbler
Enhanced understory and midstory vegetation layers	Black-throated blue warbler Veery Canada warbler White-throated sparrow Wood thrush American redstart Black-throated green warbler
Large-diameter snags and cavity trees	Northern flicker Yellow-bellied sapsucker
Large logs on the ground	Ruffed grouse Canada warbler Ovenbird
Fine woody material is present and aggregated into piles.	Veery White-throated sparrow
Tree species diversity	All birds/general forest health
Invasive plants monitored and controlled	All birds/general forest health
Deep layer of moist deciduous leaf litter	Ovenbird, wood thrush, veery

Management Options and Considerations

A variety of silvicultural treatments could be used to achieve the desired habitat conditions described in the previous sections. The following options are from *Silviculture with Birds in Mind: Options for Integrating Timber and Songbird Habitat Management in Northern Hardwood Stands in Vermont* (Appendix 4).

Mature Forest

Option 1A – Crop Tree Release with Canopy Gap Formation

Option 1B – Variable-Retention Thinning

Option 2B – Small Group and Single-Tree Selection – groups ≤ .1 acre preferable

Additional Management Considerations

Minimize harvesting during the bird breeding season - The forest bird breeding season roughly extends from May-August with the most critical time period running through the second or third week of July. Although it may not be desirable or possible to refrain from harvesting during this time frame, consider less intensive silviculture such as single-tree and small group selection. Shelterwoods and patch cut harvests during the breeding season are likely to have greater impact

on bird communities. Harvesting during frozen ground conditions is preferable as it has no direct negative impact on the breeding bird community. Winter harvesting can also help protect advanced regeneration and understory shrubs from damage.

Minimize extent of forest access roads - Forest access roads can serve as pathways for increased nest predation and parasitism, particularly in forests within an agricultural matrix. Maintain < 15 percent of a property in roads and access trails and utilize the current trail system as much as possible. Minimize long, straight stretches of access roads into the forest interior. Road/trail widths <20 ft. are preferred. Wider forest roads may decrease habitat quality for ground foraging bird species such as ovenbird along the road edge due to decreases in leaf litter moisture, increased leaf litter temperature, and subsequent lowered densities of leaf litter arthropods. Densities of birds and reproductive success may be affected.

Habitat Unit 2: Open - 2 acres

Current Habitat Conditions

This habitat unit is dominated by herbaceous plant species with scattered white pine and apple trees. There are also small patches of aspen saplings. From a forest bird perspective this habitat unit may function as a display ground in the spring for male *American woodcock*. The buds of the aspen may provide winter food for *ruffed grouse*. *Nashville warbler* may utilize the combination of open herbaceous cover and tree islands as a nest site location. Beyond bird habitat considerations this area provides some horizontal diversity to an otherwise heavily forested landscape. For this reason it is highly valuable for general wildlife purposes.



Old field habitat

Management Options and Considerations

This area has been actively managed by the Town of Berlin for the purposes of maintaining open land, enhancing value of apple trees, and controlling non-native plant species. This regime should continue.

Conduct brush hogging outside the bird breeding season - The bird breeding season roughly extends from May-August with the most critical time period running through the second or third week of July. Brush hogging in late summer or early fall is preferable as it is less likely to have a direct negative impact on the breeding bird community.

Appendix 1: Responsibility Bird Species

Appendix I



Responsibility Bird Species

The Atlantic Northern Forest of Vermont, New Hampshire, Maine and New York provide breeding habitat to dozens of bird species. For some species, as much as 90% of their global population is breeding in this region. Many of these birds are seeing long-term declines that may be indicating larger ecosystem problems. The North American Bird Conservation Initiative (NABCI) defines birds like these as responsibility birds. A responsibility bird has a high proportion of its global population breeding in the region, and therefore species conservation efforts should be focused in this area. The following are birds Audubon Vermont has recognized as responsibility species in our region based on the work by NABCI.



- | | |
|------------------------------|---------------------------|
| Alder Flycatcher | Magnolia Warbler |
| American Redstart | Mourning Warbler |
| American Woodcock | Nashville Warbler |
| Bay-breasted Warbler | Northern Flicker |
| Bicknell's Thrush | Northern Parula |
| Black-backed Woodpecker | Olive-sided Flycatcher |
| Blackburnian Warbler | Ovenbird |
| Blackpoll Warbler | Palm Warbler |
| Black-throated Blue Warbler | Purple Finch |
| Black-throated Green Warbler | Ruffed Grouse |
| Blue-headed Vireo | Rusty Blackbird |
| Boreal Chickadee | Scarlet Tanager |
| Canada Warbler | Spruce Grouse |
| Cape May Warbler | Swamp Sparrow |
| Chestnut-sided Warbler | Tennessee Warbler |
| Chimney Swift | Veery |
| Eastern Wood-Pewee | White-throated Sparrow |
| Gray Jay | Wood Thrush |
| Lincoln's Sparrow | Yellow-bellied Flycatcher |
| Louisiana Waterthrush | Yellow-bellied Sapsucker |

Photos from top to bottom: Magnolia Warbler, Blackburnian Warbler, Bicknell's Thrush, Scarlet Tanager. Bicknell's Thrush photo provided by the Vermont Institute of Natural Science, Blackburnian Warbler and Scarlet Tanager by Charlie Eiseman, Magnolia Warbler by Powdermill Banding Station in PA.

Appendix 2: Habitat Terms and Explanations

Area-sensitive Bird Species: A bird species such as the wood thrush and scarlet tanager that increases in abundance and/or achieves higher nesting success with increasing forest patch size.

Canopy: The combined cover of individual tree crowns.

Importance for Forest Birds: Canopy height influences nesting site potential for responsibility birds in both young and mature forest habitats. For birds that nest in young forest habitats – such as chestnut-sided and mourning 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 and blackburnian warbler, nest site selection is strongly associated with increasing canopy height. Forest stands ≥ 1 acre in size with an open canopy (<30% closure) are likely to provide young forest habitat conditions. An intermediate canopy (30-80% 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.

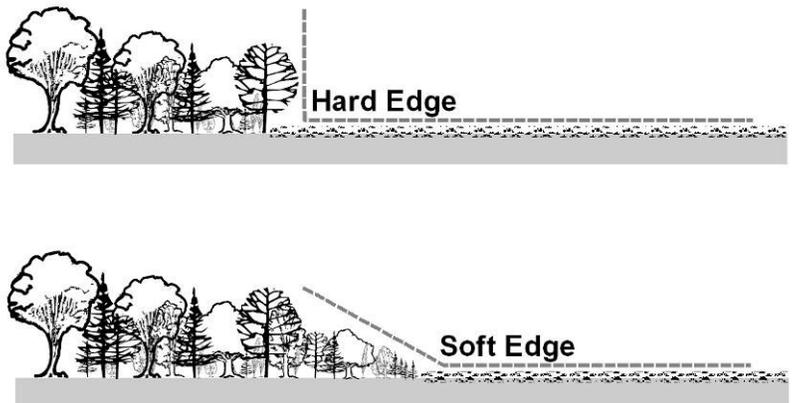
Coarse and Fine Woody Material: Coarse woody material (CWM) is downed logs and branches >4 inches diameter. Fine woody material (FWM) is limbs and branches <4 inches diameter including slash.

Importance 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 >8 inches diameter as drumming perches. When aggregated in piles (e.g. tree tops or slash piles) FWM offers a nesting substrate and cover for white-throated sparrows and veeries. Scattered individual pieces have minimal habitat value.

Edge: The boundary between forest and open land, such as a field or backyard.

Importance for Forest Birds:

The transition from low herbaceous vegetation to tree canopy can be considered either a “soft” or “hard” edge. A soft edge is a gradual change in vegetation height moving into the forest. This gradual transition is important for buffering interior forest specialists like the wood thrush from the incursions of nest predators (such as raccoons and skunks) and nest parasites (such as the brown-headed cowbird) that are frequently found in open and developed areas. A gradually increasing canopy height helps to shield



interior-nesting birds from view by predators and parasites. Additionally, the brushy conditions that often develop in a soft edge may provide breeding habitat for young forest habitat bird species including chestnut-sided warbler and white-throated sparrow.

Fragmented Forest: Forest that is broken into small, unconnected patches primarily due to some form of development (e.g. residential, commercial, or major roads).

Importance for Forest Birds: A fragmented forested landscape is more likely to support “generalist” wildlife species, such as raccoons and skunks, which can decrease nesting success of interior-nesting forest birds.

Hardwood Forest: A forest dominated by broad-leaved trees which lose their leaves in the fall.

Importance for Forest Birds: Some breeding birds are associated with hardwood forests, such as chestnut-sided warbler, eastern wood-pewee, and scarlet tanager.

Horizontal Structure: The arrangement of different habitat types across the landscape.

Importance for Forest Birds: A landscape with mature and young forest habitats, open fields, and wetlands would be rich in horizontal diversity. Landscapes with greater horizontal diversity support a greater diversity of breeding forest birds and other wildlife.

Interior Forest: Forest condition that occurs with increasing distance from a forest edge.

Importance for Forest Birds: As perceived from a bird’s perspective, interior forest conditions begin to occur approximately 200-300 feet from a forest edge. At this distance, negative edge-associated effects such as nest predation and parasitism generally no longer occur. Interior-nesting species, such as scarlet tanager, wood thrush, ovenbird, black-throated blue warbler, and blue-headed vireo, have greater reproductive success when they nest away from forest edges.

Invasive Plant: A plant that is able to establish on many sites, grow quickly, and spread to the point of disrupting native ecosystems. Often non-native.

Importance for Forest Birds: Non-native, invasive plants, such as bush honeysuckles, buckthorn, and Japanese barberry, present a variety of threats to forest health in Vermont and the northeast. Although some species of native forest birds successfully use these 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 forest ecosystems. Overall, non-native, invasive plant species degrade the quality of native forest bird habitat in our region.

Leaf Litter: Dead plant material such as leaves, bark, and twigs that has fallen to the ground.

Importance 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, veery, 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.

Mature Forest Habitat: Forest with a canopy greater than 20 feet tall.

Importance for Forest Birds: Many responsibility birds breed in mature forest habitats where they find nest sites, cover, and food. Typically, the quality of mature forest habitat increases for forest birds as a forest ages and structure diversifies. Pole stands – the youngest type of mature forest habitat - are typically structurally simple and attract a small suite for forest birds including ruffed grouse and American redstart. Older stands with understory and midstory layers, canopy gaps, large trees, snags, and logs, attract a much greater diversity of birds including black-throated blue warbler, wood thrush, Canada warbler, and black-throated green warbler.

Midstory: Live, woody vegetation in the 6-30 foot height range including trees and shrubs.

Importance for Forest Birds: High stem and foliage densities of woody plants in this forest layer provide nest sites, foraging substrates, and protective cover for many forest birds. Stand-wide coverage is desirable but not necessary; well distributed patches are sufficient. The majority of responsibility bird species nest and/or forage within the first 30 feet of the forest. Nests of wood thrush, American redstart, black-throated green warbler, and blue-headed vireo are most commonly found in the midstory level.

Mixedwood Forest: A forest made up of hardwood and 25-75% softwood tree species.

Importance for Forest Birds: Some breeding birds are associated with mixedwood forests, such as black-throated blue warbler, Canada warbler, and white-throated sparrow.

National Audubon Society WatchList: An analysis by the National Audubon Society and American Bird Conservancy which uses the latest available research from the bird conservation community along with citizen science data to identify bird species in the continental U.S. and Hawaii that are in need of immediate conservation help. It is a call to action to save species fighting for survival amid a convergence of environmental challenges, including habitat loss, invasive species and global warming. Wood thrush and Canada warbler are Audubon WatchList species.

Snags and Cavity Trees: Snags are standing dead or partially dead trees that are relatively stable. Cavity trees may be alive or dead.

Importance for Forest Birds: Snags provide opportunities for nesting cavity excavation by yellow-bellied sapsuckers and northern flickers, and existing cavity trees provide potential nesting cavities for chimney swifts. Aspen and birch species are frequently chosen as trees to excavate. Cavities are often made in trees with the heartwood and sapwood decay fungi. Suggested targets for snags and cavity trees combined in are ≥ 6 per acre, with one tree >18 inches DBH and 3 >12 inches DBH. Branches on snags may be used as foraging perches and nest sites.

Soft Mast: Soft fruits.

Importance for Forest Birds: Fruits including cherry, apple, *rubus* species (e.g. blackberry and raspberry), dogwood, and others are important food sources for forest birds. In the late summer and early fall, after fledging and before migrating, many birds feed on these fruits and the insects that are attracted to them in order to build up critical fat reserves needed to endure long fall migrations.

Softwood Forest: A forest dominated by coniferous trees, usually “evergreen” (the exception being tamarack), with needles or scale-like leaves.

Importance for Forest Birds: Some breeding birds are associated with softwood forests, such as magnolia warbler and blue-headed vireo. Other birds, such as Blackburnian and black-throated green warbler, are associated with small clusters of softwood trees called exclusions in hardwood stands. For this reason, maintaining or increasing the softwood component of hardwood stands increases their overall habitat value. Several responsibility species are associated with softwood forests that are dominated by spruce and fir. Bicknell’s thrush is associated with these forests found at high-elevations in the mountains, and species including boreal chickadee, spruce grouse, and black-backed woodpecker, are associated with lowland spruce-fir forests in the northern parts of our region that are characterized by a short growing season and cold climate.

Understory: Live vegetation in the 1-5 foot height range, including tree seedlings and saplings, shrubs, and herbaceous vegetation.

Importance for Forest Birds: High stem and foliage densities of woody plants in the understory provide nest sites, foraging substrates, and protective cover for many forest birds. 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 sugar maple, American beech, hobblebush, red spruce, *rubus* species, and striped maple. Black-throated blue warbler and wood thrush place nests in this layer, and Canada warbler and veery tend to nest on or near the ground, concealed by dense understory growth. The best breeding habitats for mourning warbler and chestnut-sided warbler are patches of dense, low growth with <30% overstory cover in patches >1 acre in size (young forest habitat conditions).

Vertical Structure: The complexity of vegetation and other structures as they are vertically arranged in the forest.

Importance for Forest Birds: A forest with a well-developed understory, midstory, and canopy exhibits complex or diverse vertical structure, which offers habitat for a greater array of bird species compared with a structurally simple forest. Non-living features, such as coarse woody material and the microtopography of the forest floor, add to the complexity of vertical structure as well.

Young Forest Habitat: Forest patches greater than one acre in size dominated by a high density of seedlings, saplings, and shrubs less than 20 feet tall.

Importance for Forest Birds: Several responsibility birds and many other wildlife species use young forests during all or part of their life cycle. Chestnut-sided warbler, American woodcock, and magnolia warbler all use young forests during the breeding season. Although these species may be found in patches smaller than one acre in size, research has shown that abundance and nesting success is greater in larger patches. Young forest habitats include regenerating patchcuts, clearcuts, and old fields. Early-successional young forest habitats dominated by intolerant species such as aspen and paper birch are particularly valuable for woodcock and grouse. Shrublands that will never mature into forest, such as those associated with beaver wetland complexes, can also attract species associated with young forest habitats

since they have a similar vegetative structure. Recent research has also shown the importance of young forest habitats as post-breeding habitat for birds that nest in mature forest, such as scarlet tanager and wood thrush. Young forest provides dense, protective cover for juveniles, as well as abundant sources of soft mast, which are important pre-migration food sources. Young forest habitats are ephemeral; they generally only persist 10-15 years where forest regenerates after a patch or clearcut and slightly longer on old field sites. Due to natural forest succession and development, the amount of this habitat type is decreasing in our region, which is a threat to the species associated with it.

Appendix 3: Additional Forestry Terms

Source: Vermont Land Trust Forestry Glossary

Acre: A standard unit of area measure. One acre equals: 43,560 square feet; 4840 square yards; 10 square chains.

Advance regeneration: Natural regeneration that is established prior to a timber harvest.

Age Class: One of the intervals, commonly 10-20 years, into which the age range of trees are divided for classification.

Browse: Buds, leaves, and twigs of seedling and sapling regeneration that are utilized as a food resource by wildlife.

Clearcut: A silvicultural method which removes all trees from a designated area at one time for the purpose of creating a new, even-aged stand. This management system is usually used to regenerate shade-intolerant tree species. Variations include patch and strip clearcutting.

Crop Trees: Trees to be grown to the end of the rotation in even-aged management or trees to be favored for future growth in uneven-aged management.

Crown: The branches and twigs of the upper part of a tree.

Diameter at Breast Height (DBH): The diameter of a standing tree measured at 4.5 feet above the ground and expressed in inches.

Even-aged: An age class description of a stand in which the age of the trees is relatively close, usually within 20 years. Stands with two distinct age classes can also be referred to as even-aged.

Forest Management Plan (FMP): A long range plan designed to identify a landowner's goals and objectives and the silvicultural methods that will be employed to achieve those goals. FMP's in Vermont are typically written for a 15 year period and updated every 10 years.

Forest Type: A natural group or association of different species of trees which commonly occur together over a large area. Forest types are defined by one or more of the dominant species of trees in the type.

Forestry: The art and science of growing and managing forests and forest lands for the continuing use of their resources.

Girdle: To destroy the conductive tissue of a tree in a ring around the bole or trunk. A technique often used to create snags.

Harvest: A silvicultural treatment that is intended to establish regeneration. A harvest is generally a higher level of cutting intensity than a thinning.

High-grading: A liquidation cut in which only the best quality, highest value trees are removed. Cuts of this nature are short sighted and exploitative and result in the degradation of the forest ecosystem.

Individual Tree Selection: An uneven-aged harvesting method designed to favor tolerant species. Trees are removed individually to maintain a continuous and uniform crown cover. Also referred to as single tree selection.

Intermediate Treatments: The removal of trees from a stand between the time of establishment and the final harvest with the purpose of improving stand growth and/or species composition and/or health.

Intolerant Species: Trees unable to grow and develop in the shade of other species. Intolerant commercial species in Vermont include: paper birch and aspen.

Landing: Any place where logs are assembled for further transport.

Mast: Nuts, berries, and seeds utilized by wildlife as a food resource.

Overstory: Those trees making up the main canopy. The overstory is usually referenced as the larger trees in the stand.

Pole or Pole Timber: A tree or trees greater than 4.0 inches DBH and less than 10.0 inches DBH.

Prescription: A course of action to effect change in a forest stand (e.g. harvest, thinning, or planting).

Regeneration: Renewal of a tree crop by natural or artificial means.

Release: The freeing of well-established seedlings or saplings from surrounding growth.

Residual: Trees that are left to grow in a stand after a silvicultural treatment.

Rotation: The length of time required to grow an even-aged crop of trees to a desired age.

Rotation Age: The age at which an even-aged stand is considered ready for harvest.

Salvage Cut: The removal of dead, dying, and damaged trees after a natural disaster or insect or disease infestation to utilize the wood before it loses all of its commercial value.

Sapling: Trees taller than 4.5 feet but less than 5.0 inches DBH.

Sawlog: A log considered suitable in size and quality for producing lumber. Regional standards apply for diameter, length and freedom from defect. Sawlog is also used to refer to a tree that has

reached sufficient size to produce a sawlog. Small sawlog trees are 12-16 inches DBH, medium sawlog trees are 17-20 inches DBH, and large sawlog trees are 22 inches DBH or greater.

Sawtimber: Trees that have obtained a minimum diameter at breast height that can be felled and processed into sawlogs. Typical minimum size limits for commercial species in Vermont are 8 inches DBH for softwoods and 12 inches DBH for hardwoods.

Seedlings: Trees that are less than 4.5 feet tall.

Shade tolerance: The ability of trees to reproduce and grow in the shade of other trees. Tolerance ratings are very tolerant, tolerant, intermediate, intolerant, and very intolerant.

Silviculture: Manipulation of the forest ecosystem to achieve specific goals and objectives.

Skid Trail: Any path in the woods over which multiple loads of logs are hauled, usually by a skidder or tractor. Primary skid trails are the main pathways that enter the landing.

Stand: A community of trees possessing sufficient uniformity in regards to composition, constitution, age, spatial arrangement or condition to be distinguishable from adjacent communities.

Stocking: An indication of the number of trees in a stand as compared to the optimum number of trees required to achieve some management objective, usually improved growth rates or increased timber values.

Tolerant Species: Trees that can grow satisfactorily in the shade of other trees. Tolerant species of commercial importance in Vermont include sugar maple, beech, red spruce, and hemlock.

Uneven-aged: An age class description of a stand of trees that contains more than two distinct age classes and a variety of size classes.

Blowdown: A tree or trees that have been toppled by high winds. A common phenomenon along the edge of strip cuts and clearcuts.