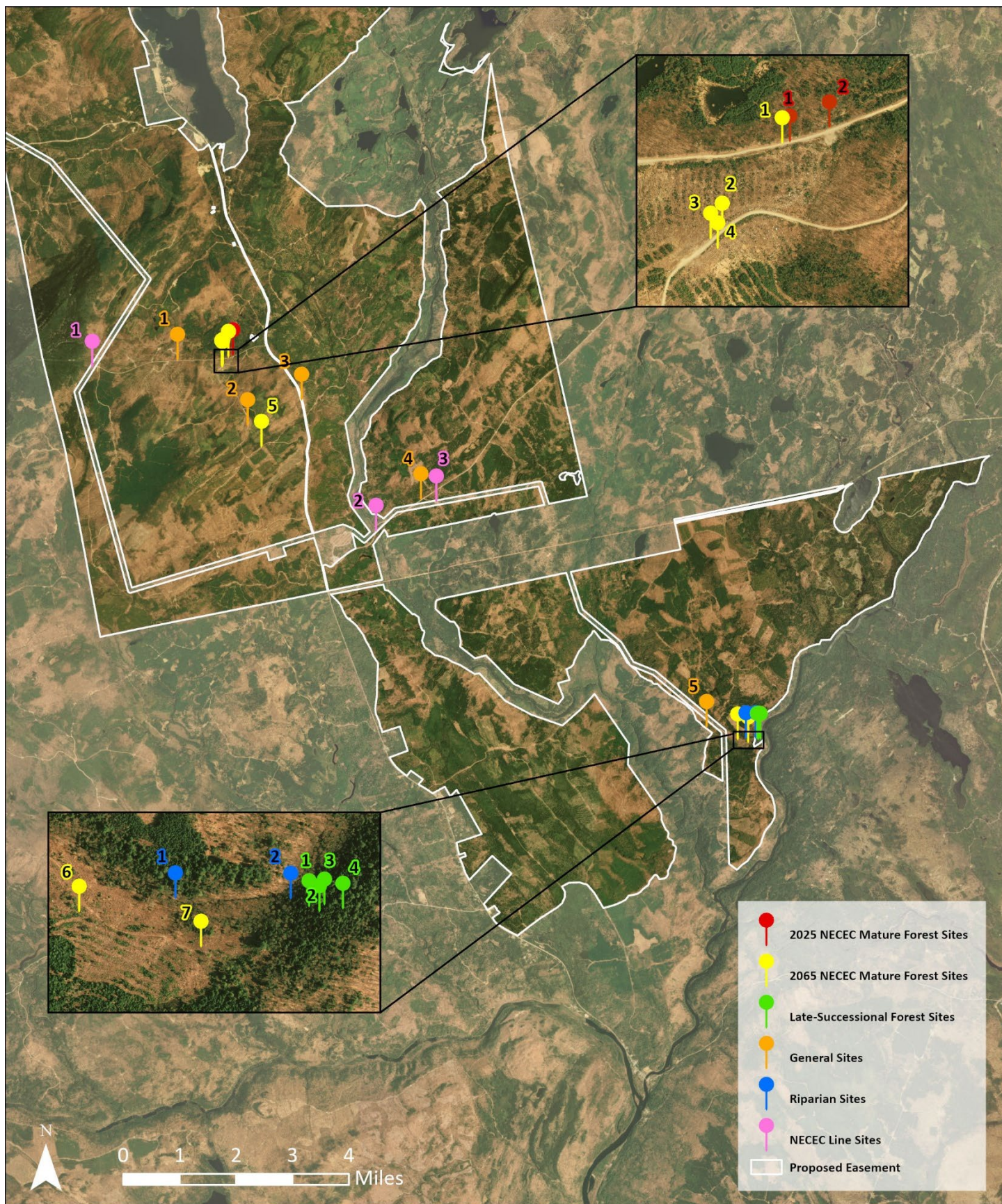


**Appendix A** – Representative Photographs Within the Conservation Area and Representative Photographs of Ecologically Mature Forest Outside the Conservation Area





**Figure A-1.** Map of sites where photographs were taken within the proposed conservation area by the Natural Resources Council of Maine and Maine Audubon on November 11, 2025.



**2025 NECEC Mature Forest Sites [Red]** – Sites currently within the  $\geq 50$  feet forest height group as identified by NECEC in the FMP

Site 1 (Looking North):





Site 2 (Looking North):





**2065 NECEC Mature Forest Sites [Yellow]** – Sites projected to be within the  $\geq 50$  feet forest height group by 2065 as identified by NECEC in the FMP

Site 1 (Looking South):





Site 2 (Looking West):





Site 3 (Looking West):





Site 4 (Looking East):





Site 5 (Looking South-East):





Site 6 (Looking South):





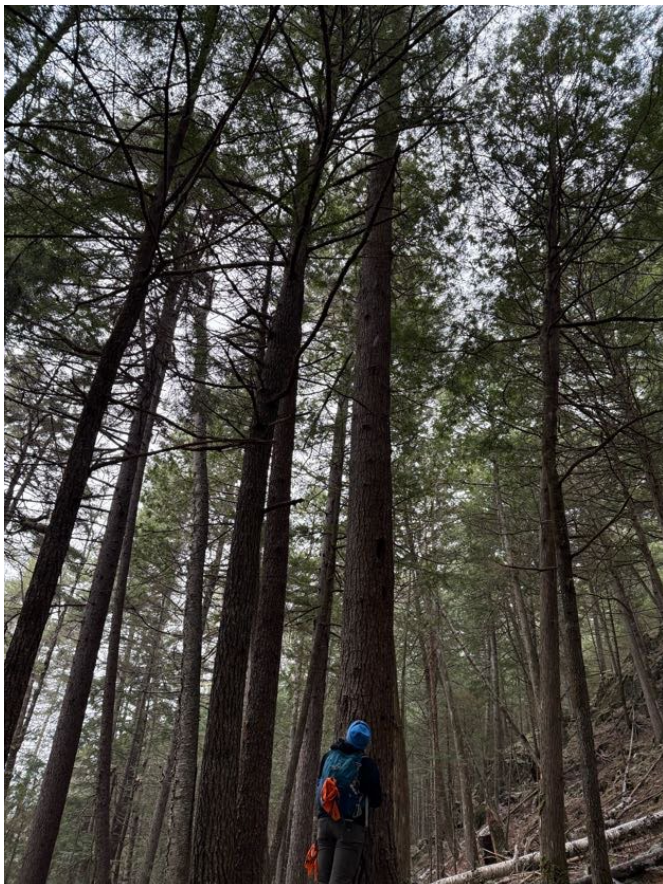
Site 7 (Looking West):





**Late-Successional Forest Sites [Green]** – Sites within the proposed conservation area identified as late-successional forest according to Dr. John Hagan's LiDAR analysis

Site 1 (Looking East):





Site 2 (Looking West):





Site 3 (Looking East):





Site 4 (Looking North-East and South-East, respectively):





**General Sites [Orange]** – Sites of other commonly observed forest conditions within the proposed conservation area

Site 1 (Looking North-West):





Site 2 (Looking South-East):





Site 3 (Looking North-West and West, respectively):





Site 4 (Looking North-West):





Site 5 (Looking North-East):





**Riparian Sites [Blue]** – Sites within a designated riparian buffer area within the proposed conservation area

Site 1 (Looking East):





Site 2 (Looking North-West):





**NECEC Line Sites [Pink]** – Sites within the NECEC corridor adjacent to the proposed conservation area

Site 1 (Looking North-East and South-West, respectively):





Site 2 (Looking North-West and North-East, respectively):





Site 3 (Looking East and West, respectively):





**Other Representative Photos of Ecologically Mature Forests** – Sites within Maine that are outside of the proposed Plan area but are representative of ecological mature forests (photos by Our Climate Common and Maine Audubon)

Transitioning Late-Successional Forests:









Late-Successional Forests:













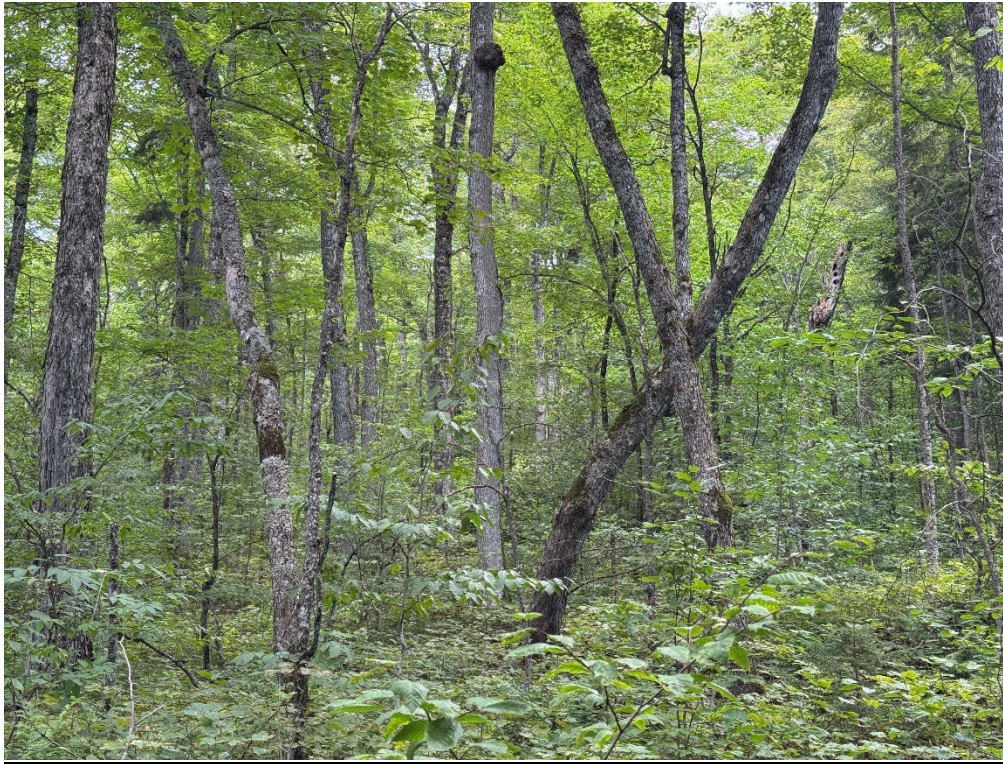




Old-Growth Forests:













Other Mature Forests:



















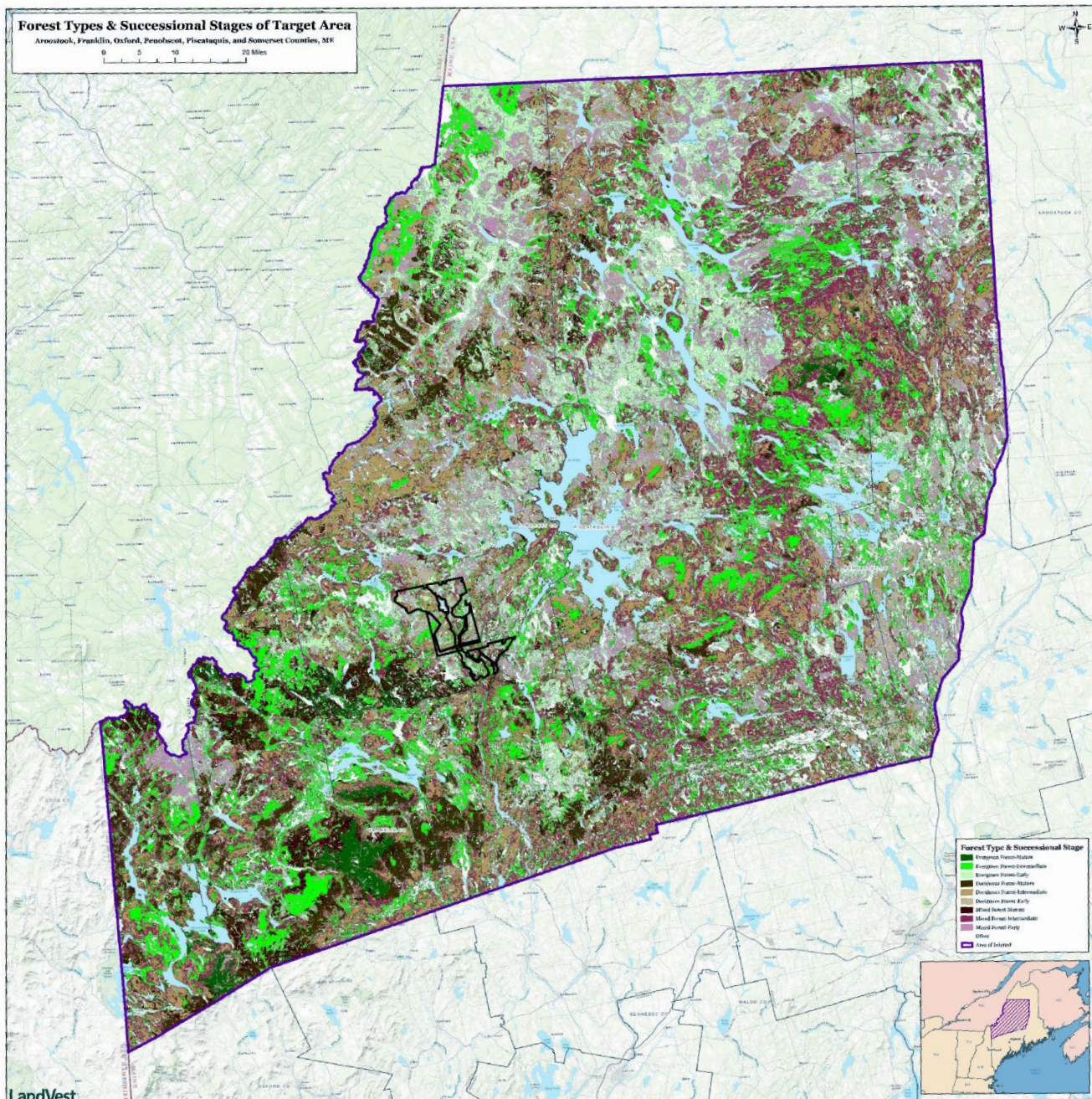


**Appendix B** – Map of NECEC’s Forest Types & Successional Stages Data from the 2021 Conservation Plan with the Proposed 50,000-Acre Conservation Area from the 2025 Plan Overlaid



**Forest Types & Successional Stages of Target Area**  
Aroostook, Franklin, Oxford, Penobscot, Piscataquis, and Somerset Counties, ME

0 5 10 20 Miles



LandVest

Map Date: 10/15/2019  
Map Author: [illegible]  
Map Title: Forest Types & Successional Stages of Target Area



**Appendix C** – List of Recent Significant Conservation Projects in Western Maine with Associated News Articles



## Recent and Current Conservation Projects in Western Maine

Hilton Timberlands, purchased by The Conservation Fund -- (Jackman area) 44,000 acres

- [National land trust purchases 44,000 acres near Jackman | Maine Public](#)
- [Near Jackman, land conservation group buys 44,000 acres for \\$44 million | Central Maine](#)
- [Maine's Hilton Timberlands Sell to The Conservation Fund | Land Report](#)
- [The Conservation Fund Protects Jobs, Outdoor Recreation in Northwestern Maine | The Conservation Fund](#)
- [Conservation group buys 44,000 acres in northwest Maine for \\$44.4M | Mainebiz](#)
- [Deal Preserves 44,000 Acres In Maine | Northeast Explorer](#)
- [Near Jackman, land conservation group buys 44,000 acres for \\$44 million | Portland Press Herald](#)

Magalloway Project, involves The Nature Conservancy, Rangeley Lakes Heritage Trust, Northeast Wilderness Trust – (Rangeley area) 80,000 acres

- [The Magalloway Conservation Collaborative Maine | Magalloway.org](#)
- [Magalloway Wilderness Preserve | Northeast Wilderness Trust](#)
- [Magalloway Lands & Waters | Forest Society of Maine](#)
- [Magalloway Conservation Initiative Aims to Protect 78,000 Acres in Western Maine | From the Ground Up](#)
- [New Collaborative Aims to Protect 78K Acres in Northwest Maine | Explore New England](#)
- [Rangeley Lakes Heritage Trust | Conserve the Rangeley Lakes Region](#)
- [Conservation groups pursue massive Western Maine land deal | Maine Public](#)
- [Lakes Region Restoration Project Aims to Link Conservation Lands From Maine to New Hampshire | Inside Climate News](#)
- [New collaboration looks to raise \\$62M to protect western Maine woods | WGME](#)



**Moxie Pond, Trust for Public Lands – (Bald Mountain Township) 1,845 acres**

- [Moxie Pond | Trust for Public Land](#)

**South Bog, Rangeley Lakes Heritage Trust – (Rangeley area) 13,000 acres**

**South Branch Forest, Trust for Public Lands – (between Rangeley and Eustis) 3,800 acres**

- [South Branch Forest - Our Work in ME | Trust for Public Land](#)

### **Recently Closed**

**Keystone Projects, involves Maine Appalachian Land Trust, The Nature Conservancy, Bureau of Parks and Lands – (Madrid and Salem Townships) 2,706 acres**

- [Over 2,700 Acres of Critical Wildlife Habitat Protected in Maine | The Nature Conservancy](#)
- [Keystone-Orbeton Cascades | Maine Appalachian Trail Land Trust](#)
- [Land Use & Conservation Team Helps Protect Over 2,700 Acres of Critical Wildlife Habitat in Maine's High Peaks Region | Drummond Woodsum](#)
- [Over 2,700 Acres of Critical Wildlife Habitat Protected in Maine's High Peaks Region | Maine Department of Agriculture, Conservation and Forestry](#)
- [News: Newsroom | Maine Department of Agriculture, Conservation and Forestry](#)

**Kennebago, Rangeley Lakes Heritage Trust – (Rangeley Region) 10,000 acres**

- [Kennebago Headwaters Project | Rangeley Lakes Heritage Trust](#)

**Scammon Ridge, Forest Society of Maine – (Moosehead Region) 3,000 acres**

- [Partnerships, Community Support, and Fondness of Place Conserve 3,000 acre | Forest Society of Maine](#)
- [Forestry fund looks for environmental, financial returns in purchase of 3,000-acre Greenville forest | New England Forestry Foundation](#)
- [Land conservation easement protects 3000 acres, Greenville, ME | newscentermaine.com](#)
- [Partnerships, community support, and fondness of place conserve 3,000 acres at Scammon Ridge | Piscataquis Observer](#)
- [Scammon Ridge Headwaters | Forest Society of Maine](#)
- [3,000 acres on east shore of Moosehead Lake protected from development | Maine Public](#)



- [Conservation groups protect 3,000 acres near Moosehead Lake | Spectrum Local News](#)
- [Press Release: Acquisition of 3,000-Acre Maine Forest by Innovative New Investment Fund | Quantified Ventures](#)
- [New Investment Fund Seeks Environmental and Financial Returns | New England Forestry Foundation](#)
- [Land trust makes great strides in helping to preserve Maine's most pristine region | Piscataquis Observer](#)

**Barnard Project, Appalachian Mountain Club – (Moosehead Region) 29,000 acres**

- [\\$10 Million MathWorks Gift Powers Appalachian Mountain Club's Permanent Protection of Barnard Forest](#)
- [With deal, Appalachian Mountain Club conservation area is now 3 times larger than Acadia | Mainebiz](#)
- [Nearly 29,000 Acres Purchased in Maine's North Woods to Expand Appalachian Mountain Club's Maine Woods Initiative - The Conservation Fund](#)
- [Barnard Forest – Appalachian Mountain Club](#)
- [Purchase finalized for permanent conservation of Barnard Forest in Piscataquis County | Maine Public](#)
- [Maine's Barnard Forest now under permanent protection | Spectrum Local News](#)
- [Penobscot Nation to reclaim 1,700 acres in rural Maine as tribe grows land holdings | Portland Press Herald](#)

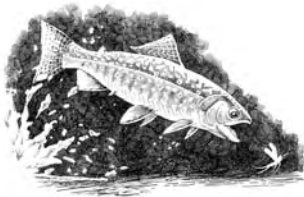


**Appendix D** – Scientific Articles of Habitat Requirements for Species Referenced in the Record  
Other Than Pine Marten That Prefer Mature Forest



# Focus Species Forestry

## A Guide to Integrating Timber and Biodiversity Management in Maine



*Robert R. Bryan*  
*Forest Ecologist and Licensed Forester*  
*Maine Audubon*

**Third Edition**—March 2007  
Published by Maine Audubon in cooperation with:

Maine Department of Conservation  
Professional Logging Contractors of Maine, Master Logger Program  
Small Woodland Owners Association of Maine

MAINE   
AUDUBON





First Edition: April 2004

Second Edition: September 2004

Third Edition: March 2007. The third edition includes some higher quality images and updates to the vernal pool, riparian, and northern goshawk guidelines.

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(877) 467-9626  
<http://www.swoam.com/>



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# Acknowledgements

The Focus Species Forestry Project is a partnership of Maine Audubon, the Maine Department of Conservation, the Professional Logging Contractors of Maine, and the Small Woodland Owners of Maine. This manual was prepared with the support of grants from the Maine Outdoor Heritage Fund and the William P. Wharton Trust. Additional support for workshop presentations has been provided by members and friends of Maine Audubon, the Professional Logging Contractors of Maine, the Small Woodland Owners Association of Maine, the Davis Conservation Foundation, the Home Depot Foundation, and the Wendling Foundation.

## Focus Species Forestry Advisory Committee

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| Andy Whitman    | Manomet Center for Conservation Sciences            |

In addition to the advisory committee, the following individuals generously provided helpful comments on the manual:

|                     |                                                                  |
|---------------------|------------------------------------------------------------------|
| Dan Harrison        | University of Maine (American marten)                            |
| Mitchska Hartley    | National Audubon / Cornell Lab of Ornithology                    |
| Tom Hodgman         | Maine Department of Inland Fisheries and Wildlife                |
| Richard Hoppe       | Maine Department of Inland Fisheries and Wildlife                |
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| Phillip deMaynadier | Maine Department of Inland Fisheries and Wildlife (vernal pools) |
| Will Reid           | Skowhegan Maine                                                  |
| Sally Stockwell     | Maine Audubon                                                    |



This manual would not have been possible without the many researchers and managers whose work has provided the inspiration and scientific basis. A short list includes: Richard DeGraaf, Mariko Yamasaki, and Bill Leak of the U.S. Forest Service; Mac Hunter, Bob Seymour, Dan Harrison, and Aram Calhoun of the University of Maine; Phillip deMaynadier of the Maine Department of Inland Fisheries and Wildlife; Andy Cutko and Sue Gawler of the Maine Natural Areas Program; Paul Karczmarczyk of the Ruffed Grouse Society; the authors and advisory committee members of *Biodiversity in the Forests of Maine: Guidelines for Land Management* as well as the authors of *A Forester's Guide to Managing Wildlife Habitats in Maine* and *Maine Amphibians and Reptiles*. Thanks also to Becca Wilson, Marie Malin and Joy Felio of Maine Audubon for their assistance in producing this guide.

Illustrations by Mark McCollough, Andrea Sulzer, and US Fish and Wildlife Service.

Photographs by Robert Bryan except as noted.



# 1. Introduction

It's a crisp winter morning with fresh snow weighing heavily on the branches of the mature spruce and fir. Two men and a woman—logger, landowner, and forester—are observing the bounding tracks of an American marten that cross the road from a recently thinned softwood stand to the mixedwood stand above. Further on they stop and climb out of the truck by a patch of dense spruce-fir regeneration, the result of a shelterwood cut about 10 years ago. The site is crisscrossed by the tracks of snowshoe hare, which survive the winter on hardwood browse but seek shelter from predators in the low,



*Evidence of focus species suggests that the landowner's goals of wildlife management and timber harvesting are being met in this woodlot. Photo: Maine Audubon.*

dense branches of the young conifers. While the primary focus of this ownership is timber production, they are looking for signs that a healthy balance of wildlife habitat is being maintained, and the results are encouraging. Signs of both the marten, which requires large areas of relatively mature forest, and snowshoe hare, which prefers young stands, have been seen, suggesting that other animals associated with these forest stages should also be doing well.

***The goal of this manual is to simplify the task of integrating timber management and conservation of biodiversity by identifying and managing for a few Focus Species whose habitat needs cover those of many other forest species.***

Aldo Leopold once wrote, “The first rule of intelligent tinkering is to keep all the pieces.” For many landowners and managers, maintaining forest wildlife and other components of biodiversity—keeping all the pieces—is a high priority. Most small woodland owners own their land for reasons other than timber production, and

recently many large timberland owners have formally committed to conserving biodiversity through forest certification programs. Thoughtful loggers who harvest the timber also want to be sure that they are leaving behind a healthy forest.

While managing to protect native biodiversity is an important goal, the specifics are elusive. There are just too many things to keep track of. For starters, there are 173 species of forest birds in Maine. Add in reptiles, amphibians, mammals, insects, plants, fungi, forest ecosystems, and genetic diversity and the job of managing your woodlot for biodiversity feels overwhelming.



The goal of this manual is to simplify the task of integrating timber management and conservation of biodiversity by identifying and managing for a few **Focus Species** whose habitat needs cover those of many other species. In the pages that follow, a group of focus species has been identified for Maine's major commercial forest types. This approach will help forest managers develop habitat targets for specific species, like the marten and snowshoe hare, that are associated with Maine's most common forest types. By providing adequate habitat for the full suite of focus species, many other components of biodiversity will benefit as well. By focusing on a few important species, biodiversity management can become an interesting, educational, and routine part of everyday forest management.



*Barred owls prefer extensive mature forests with large cavity trees. Focusing on the habitat needs of barred owls will provide habitat for many other mature- forest species plus valuable timber.*

### **What is Biodiversity?**

*“Biodiversity is the variety of all forms of life – trees and other plants, invertebrate and vertebrate animals, and microorganisms – and includes the different levels on which life operates – from the level of genetic differences between individuals to the complex interactions between species”*(Maine Forest Biodiversity Project; Gawler et al. 1996).

To envision forest biodiversity, think about the native forest. Biodiversity is everything that lives there and all the pieces working together.



## 2. Characteristics of Focus Species

### A Suite of Umbrella Species

Focus species management works because many species inhabit similar forest types. While no two species have exactly the same habitat requirements, there is often considerable overlap among species. For example, the American marten, red squirrel, red-breasted nuthatch, spruce grouse, and hermit thrush have different requirements for food and cover, but they are all found in mid- to late-successional spruce-fir conifer and mixed conifer-hardwood forests. Because the marten has the largest home range of this group, it has been identified as a focus species. By focusing on marten management, other species with smaller territories will also benefit. This approach is also called the “umbrella species” approach, because many species benefit from the protective “umbrella” of marten management.

The goal of focus species forestry is to provide habitat for the vast majority of forest species. To account for the range of habitat needs of Maine’s wildlife and other aspects of biodiversity, focus species management is based on a suite of focus species that cover the habitat requirements of most other species found in the area. For example, the marten is typically found in older forests, while animals such as the ruffed grouse, magnolia warbler, and snowshoe hare thrive in younger conifer forests. This guide includes a suite of focus species that spans the range from early successional to late-successional forests in Maine’s six major forest ecosystems. By also including two widespread special-value habitats—riparian and wetland forests as well as vernal pools—the full range of habitats encountered in the course of everyday forestry is covered.

Focus species forestry will benefit all reptiles, amphibians, birds, and mammals associated with Maine’s forest. Less is known about the relationship of some plants and forest management, and knowledge of forest invertebrates and fungi is very limited.

| Umbrella Species Effect of Managing for American Marten in Northern Maine |                                |
|---------------------------------------------------------------------------|--------------------------------|
| Species Group                                                             | Number of Species <sup>1</sup> |
| Reptiles                                                                  | 3 (100%)                       |
| Amphibians                                                                | 8 (50%)                        |
| Mammals                                                                   | 40 (80%)                       |
| Birds                                                                     | 80 (70%)                       |
| Plants                                                                    | Hundreds?                      |
| Fungi                                                                     | Hundreds?                      |
| Insects                                                                   | Thousands?                     |

<sup>1</sup> Estimate based on DeGraaf and Yamasaki 2001, Gawler et al. 1996; percent based on non-aquatic, forest-dependent species.



## Forest Threats and Species Selection

The ideal suite of focus species is one that assures that no other species or ecosystem types compatible with managed forests are lost. Thus, threats to the forest were critical when the advisory committee selected focus species. The primary threats identified by the committee included:

- **Mature and late-successional forest fragmentation and loss**, especially on large commercial timberlands;
- **Loss of very young forest**, particularly in parts of southern Maine where the forest is maturing and light partial harvests are common<sup>1</sup>;
- **Simplification of the forest**, in particular the decline in standing dead and down trees where “clean” silviculture or short-rotation, even-aged management is practiced; and
- **Forest loss and fragmentation**, especially due to sprawl and timberland liquidation in southern and central Maine.

These threats correspond with the major categories of focus species included in this guide: mature-forest specialists, young-forest specialists, species dependent on dead and decaying trees, and species with large home ranges. Also included were species associated with special-value forest habitats, including forests adjacent to streams, lakes, forested wetlands, and vernal pools. Fortunately, forest landowners and managers can offset these threats and use appropriate management around special habitats, thereby helping to ensure that the habitat needs of focus species, and hence the majority of Maine’s forest wildlife, are met.

| A Suite of Focus Species:<br>The Spruce-Fir Ecosystem as an Example |                                                                                                                          |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Species                                                             | Reason Selected as Focus Species                                                                                         |
| Snowshoe hare                                                       | Early successional species; critical food source for many predators                                                      |
| Magnolia warbler                                                    | Representative of early successional bird community                                                                      |
| American marten                                                     | Requires large blocks of relatively mature and mature forest                                                             |
| White-tailed deer                                                   | Dependent on extensive mature softwoods for winter survival in northern Maine                                            |
| Black-backed woodpecker                                             | Requires dead trees for feeding and cavity nesting; cavities provide nest sites for many other secondary cavity users    |
| Redback salamander                                                  | Requires well-developed layer of leaf and needle litter; important predator of invertebrates in the forest soil food web |
| Gray horsehair lichen                                               | Primarily limited to late-successional spruce-fir forests                                                                |

---

<sup>1</sup> Some observers suggest the decline of clearcutting and the rise of partial cutting may also be leading to a loss of very young forest on the commercial timberlands of northern and eastern Maine. This could be a concern for lynx, which are found in large areas of dense, young softwoods with high snowshoe hare densities. Managers desiring to create hare-lynx habitat should be able to create similar habitat with shelterwood cutting and/or clearcutting if necessary. Scientists are in the process of developing management recommendations for lynx.

## Focus Species and Human Values

While biology helped the advisory committee define a long list of potential focus species, the values that humans place on forest wildlife helped shorten the list. Species important to humans include:

- **Flagship species:** “popular” species that help promote public support for conservation efforts. Examples from Maine might include the American marten, a symbol of the northern forest, or brook trout, which symbolizes Maine’s cool, clear rivers and streams.
- **Economically important species:** species that are important to the economy, such as fish and game or “watchable wildlife” such as moose.
- **Easy-to-identify species:** species that are easily recognized by sight (including tracks) or sound with minimal training. An ideal suite of focus species will include several that are year-round residents.



*Protecting habitat for popular and economically important species such as the brook trout benefits local communities and the many species that live in or near forest streams.*

Selecting species that humans enjoy helps build support for focus species management. In addition, several relatively obscure species or species groups were selected to represent important habitats that are less well known. These include the redback salamander, an abundant but seldom seen inhabitant of the forest leaf litter, and lichens that are found in late-successional forests.

## Focus Species, Forest Ecosystems, and Natural Communities

The Maine Natural Areas Program classifies forests, wetlands, grasslands, and other habitat types into a system of 98 natural communities that occur in 24 broader ecosystem types. There are about 24 natural communities associated with commercial timberlands.

*A **natural community** is an assemblage of interacting plants and animals and their common environment where the effects of human intervention are minimal (Gawler 2001).*

Natural communities are usually identified by their dominant vegetation, although in some forest ecosystem types, such as spruce-fir, geographic location, soils, and understory vegetation are also used.



This manual groups Maine's forested natural communities into six broad forest-ecosystem types and two special-value habitats that are the focus of the management recommendations. Appendix 2 includes the major natural communities associated with these ecosystems and special habitats.

Focus species management, while primarily focused on wildlife, also seeks to maintain natural communities and native plant diversity as part of the managed forest. Forestry that emulates the range of natural disturbances associated with different forest types—such as wind, fire, disease, or insect outbreaks—can maintain natural community characteristics. When developing a forest management plan, it is important to remember that plants and animals respond differently to forest disturbances. A key difference is that animals can roam the landscape in search of appropriate habitat, but plants are rooted and stationary. Thus, while a heavy overstory removal in a cedar stand may send wintering deer to another suitable site, the stand's rare orchids that require shade and a moist forest floor may be lost for good. Accordingly, it is important to recognize those special plant habitats and rare natural communities, such as cedar seepage forests and enriched hardwoods that are most sensitive to soil disturbance and changes in shade.



*Uncommon natural communities such as maple-basswood-ash forests (enriched hardwoods) and cedar-spruce seepage forests are habitat for many rare plants. The showy orchis shown here is found in enriched hardwoods. Photo: Maine Natural Areas Program*

### 3. Step by Step Guide to Focus Species Management

#### Overview

Focus species management is designed to mesh with traditional forest management. A recommended approach to focus species management is outlined below. The remainder of this chapter describes each step in greater detail. The Focus Species Management Planning Checklist (Appendix 5) is designed to help organize the overall process. Appendix 5 also contains a number of other forms designed to help organize this process. Appendix 6 includes an example with maps and completed forms for focus species forestry.

1. **Identify landowner objectives and desired future condition of the forest.**
2. **Classify forest stands.**
3. **Identify and map special-value areas.**
4. **Review habitat management guides.**
5. **Identify focus species and review species management recommendations.**
6. **Identify appropriate mix of forest development stages and management activities.**
7. **Integrate landowner objectives with focus species objectives.**
8. **Develop and implement stand-level recommendations.**
9. **Monitor the forest.**



*The management plan integrates landowner objectives with the habitat needs of focus species.*  
Photo: Maine Audubon

#### Step 1. Identify landowner objectives and desired future condition of the forest.

Focus species management seeks to integrate conservation of a broad spectrum of forest wildlife and other elements of biodiversity with the landowner's objectives. The first step in developing a management plan for focus species forestry is to identify and clarify the landowner's objectives.

#### Recommendation:

- ✓ Identify landowner goals and desired future condition of the forest based on financial, recreational, ecological, and other considerations appropriate to the ownership.



## Step 2. Classify forest stands.

Species-habitat relationships form the core building blocks of focus species management. From a wildlife perspective, two of the most critical components of habitat are the forest type and development stage (age and structure) of the forest. These two elements form the basis of the focus species habitat classification system.

### Recommendations:

- ✓ Review the habitat-classification system in Section 4.
- ✓ Map and classify all stands using aerial photos and/or field cruise.
- ✓ **Small ownerships:** Use aerial photographs to generally characterize the surrounding landscape. DeGraaf et al. (1992) suggest looking at an area that is up to 10 times the size of the property. For areas beyond the property, develop rough estimates of the percent of land in different development stages and forest ecosystems.
- ✓ **Large ownerships:** Classify the entire ownership using landscape planning units of 10,000 acres or more. Where ownerships abut other properties, consider the forest characteristics of the other ownerships.
- ✓ Enter and summarize the data on the Focus Species Habitat Worksheet (Appendix 5). This worksheet is available in Microsoft Excel format at:  
<http://www.maineaudubon.org/conserve/forest/index.shtml>.

## Step 3. Identify and map special-value areas.

Special-value areas include habitat for rare animals and plants, wetlands, shoreland areas along the coast, streams and lakes, deer wintering areas, and important cultural features such as cellar holes, stone walls, and areas of special importance to the landowner. While focus species management is primarily focused on common species that occur across the landscape in managed forests, it is important to identify special-value areas before developing a management plan. Appendix 4 includes descriptions of other special-value habitats.

### Recommendations:

- ✓ Identify special-value areas on the property map.
- ✓ In the organized towns, many special value areas are shown on ***Beginning with Habitat*** maps that have been prepared for many local communities. ***Beginning with Habitat*** maps and information are available from:
  - Beginning with Habitat, 93 State House Station, Augusta, ME 04333 (207) 287-8042
- ✓ In the unorganized towns, information on the location of rare, threatened, or endangered species as well as rare or exemplary natural communities is available from:
  - Maine Natural Areas Program, 93 State House Station, Augusta, ME 04333 (207) 287-8044
- ✓ In the unorganized towns, many special value areas are regulated by the Land Use Regulatory Commission.
- ✓ The field cruise of the property may reveal other special-value areas.

- ✓ For riparian and wetland areas and vernal pools, refer to recommendations in Section 5.
- ✓ Follow recommendations provide by the Maine Natural Areas Program or Department of Inland Fisheries and Wildlife for other special-value areas such as deer wintering areas and rare plant habitat. For more information, see *Biodiversity in the Forests of Maine* (Flatebo et al. 1999) for guidelines on identification and management.

#### **Step 4. Review habitat management guides.**

Section 5 includes descriptions and habitat management guides for each of the 6 forest ecosystem types and special-value habitats covered by this manual.

Recommendations:

- ✓ Review the management recommendations for the forest ecosystems and special-value habitats found on the property.

#### **Step 5. Identify focus species and review species management recommendations.**

Section 6 includes biological information and management recommendations for each of the focus species featured in this manual.

Use Figure 1 (Section 6) to identify the region of the state where the property is located.

- ✓ For a “quick start” approach, use the short list of “primary” focus species in Appendix 9; use other focus species as time and landowner interest allow.
- ✓ The Focus Species Management Worksheet (Appendix 5) can be used to summarize the data.
- ✓ List forest ecosystem types and special-value habitats from Table 1 that are found on the property.
- ✓ For each ecosystem type and special-value habitat, list the focus species for the region on the worksheet. For properties near region boundaries, it may be appropriate to use the focus species for both regions. Use the habitat types on the property and in the surrounding landscape to help guide this decision.
- ✓ Review the management guidelines for each focus species identified for the property.
- ✓ For a quick reference, refer to the Focus Species Summary Table (page 62).

#### **Step 6. Identify appropriate mix of forest development stages and management activities.**

Focus species forestry involves maintaining suitable habitat for both early successional species and those that require mature and late-successional forests. The extent that this can be accomplished on a given ownership depends on ownership size and surrounding landscape conditions.

Recommendations:

- ✓ Review the background information and management recommendations in Section 8, the guide to property-wide and landscape-scale forestry.



- ✓ Compare the summary information for the property and surrounding landscape from the Focus Species Habitat Worksheet with habitat needs for the suite of focus species for the property.
- ✓ Develop management objectives and general recommendations to promote habitat for the full suite of focus species. These can be recorded on the Focus Species Management Worksheet.

## **Step 7. Integrate landowner objectives with focus species objectives.**

Focus species forestry is a way to develop a comprehensive approach to biodiversity management while producing timber and other benefits of sound forest management. At times landowner objectives will conflict with this approach. For example, some small-woodland owners may object to the large openings required by early successional species. For others, financial constraints may limit management options. There is no single “best solution” to this problem. On small ownerships, managers will need to use professional judgment to balance objectives. Large ownerships with modeling capabilities should explore alternative management scenarios to optimize landowner objectives and habitat diversity.

Recommendations:

- ✓ Develop different management options and discuss them with the landowner.
- ✓ Identify desired future stand conditions and develop a long-term management plan that integrates the landowner objectives (Step 1) with focus species objectives (Step 6).

## **Step 8. Develop and implement stand-level recommendations.**

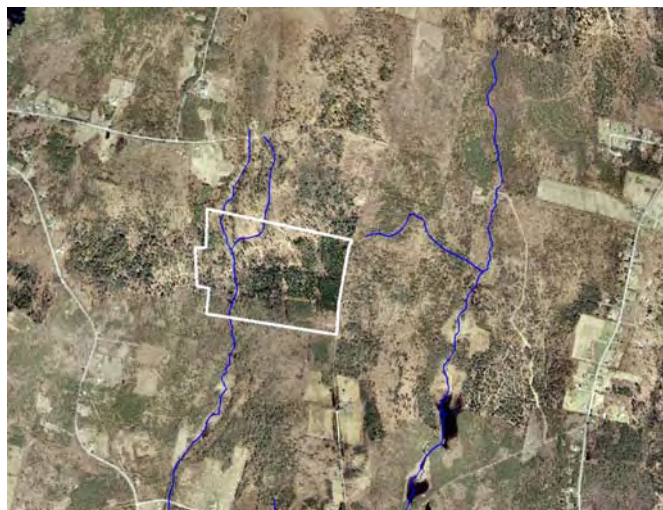
After settling on an overall management strategy the next step is to develop stand prescriptions that suit the management objectives.

Recommendations:

- ✓ Develop and implement silvicultural prescriptions and other management activities based on the objectives identified in Step 7.

## **Step 9. Monitor the forest.**

Like other aspects of forest management, focus species forestry is a long-term endeavor. Situations are not likely to be ideal on a given ownership, and even if they are they will change over time as the forest on the property and in the surrounding landscape changes. Focus species monitoring includes two main components: habitat monitoring and wildlife monitoring.



*Periodically monitor changes in habitat on the property and in the surrounding landscape.*

## Habitat Monitoring

Habitat is the most important component to monitor, because maintaining adequate habitat for the full suite of species is the key to focus species forestry.

Recommendations:

- ✓ Carefully monitor sensitive areas during and after harvest.
- ✓ Check roads and riparian zones for erosion and sedimentation during wet periods after a harvest.
- ✓ Use the Focus Species Habitat Worksheet to track the condition of the forest over time. Complete this step at the same time that the management plan is updated (every 10 years on average).
- ✓ Update management plans in response to habitat changes on the property or in the surrounding landscape.

## Wildlife Monitoring

Wildlife monitoring can be used to supplement habitat monitoring, but it is not essential to a successful focus species forestry program. However, wildlife monitoring can be an interesting and educational year-round activity. Monitoring can be developed into a systematic program or simply be a series of observations taken by foresters, landowners, and loggers while in the forest.

| Possible Wildlife Monitoring Activities |                                                                                                                                                                                                                    |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Late winter-early spring                | ✓ Conduct night surveys for calling barred owls and other owls <sup>1</sup> .                                                                                                                                      |
| Spring                                  | ✓ Check vernal pools for egg masses, spotted salamanders, and wood frogs; visit pools after a warm early spring rain and look for adult salamanders and listen for calling wood frogs <sup>1</sup> .               |
| Late spring-early summer                | ✓ Listen for songbirds defending their territory in early morning and the flute-like calls of thrushes at dusk <sup>2</sup> .<br>✓ Beware of nesting goshawks.<br>✓ Go fishing for brook trout.                    |
| Spring or summer                        | ✓ Look for stream salamanders under rocks along at the edge of intermittent streams.<br>✓ Look for redback salamanders under logs, or establish an array of small cover boards (12"x12") for long-term monitoring. |
| Summer and fall                         | ✓ Look for family groups of ruffed grouse in early successional habitat and near fruiting shrubs and trees.                                                                                                        |
| Winter                                  | ✓ Look for tracks of focus species and their predators or prey.                                                                                                                                                    |
| Year-round                              | ✓ Look for cavities and feeding signs of pileated, black-backed and other woodpeckers.                                                                                                                             |

<sup>1</sup>Maine Audubon has monitoring protocols for owls and vernal pools.

<sup>2</sup>"Birding by Ear" and "More Birding by Ear" are excellent tutorials available on CD or tape. You'll need both to learn most of Maine's forest birds.



## 4. Identifying and Classifying Focus Species Habitats

Before developing the management plan, it is important to classify forest stands into focus species habitats. The focus species classification system is based on two main elements: forest ecosystem type and development stage (relative maturity) of the forest. This system is designed to complement the forest type classification that is already being used on the forest for other objectives, such as timber production, by providing a way to translate typical map and inventory data into an ecosystem-based wildlife habitat assessment. The small number of forest ecosystems and special value-habitats will help you to quickly identify focus species for the property.

This manual uses six broad **forest ecosystem** types and two special-value habitats that reflect the habitat associations exhibited by most forest wildlife (Table 1). The six forest ecosystems used here cover the vast majority of Maine’s commercial forests. Two **special-value habitats**—riparian and wetland forest and vernal pools—have been included because they occur throughout the landscape and are critical to many wildlife species.

**Forest ecosystems**, as used in this manual, are broad associations of plants, animals, and their environment identified by dominant tree species that commonly occur together on the landscape. The forest ecosystem classification used here groups related **natural communities** identified by the Maine Natural Areas Program (see Appendix 2).

### Classifying Stands into Focus Species Ecosystems

Forest ecosystems are larger than a typical forest stand. In most cases, several stand types identified by a forester will fall within a single forest ecosystem. Special-value habitats such as vernal pools may be located within a forest ecosystem. Other special-value habitats, such as riparian forests, may be part of several forest ecosystems.

In cases where a simple classification system has been used (e.g., hardwood/softwood/mixedwood), additional information on species composition will be necessary to place stands in one of the six ecosystem types. Ecosystem classification is based on the dominant tree species. In the case of mixed deciduous-conifer stands, the dominant species approach also applies. For example, a mixed northern hardwood-spruce stand would generally be classified as falling within the northern hardwood ecosystem if the stand is greater than 50% hardwoods, or spruce-fir if greater than 50% conifers. However, site conditions such as the influence of past harvesting on species composition, surrounding stands, and the successional trajectory of the stand may suggest that an alternative ecosystem classification is more appropriate.

Except for the uncommon wetland and riparian forest types noted below, all stands should be classified into one of the six forest ecosystem types. The two special habitats are “overlay” classifications that will be used to modify the general approach to management within each ecosystem type. For example, where a spruce-fir stand extends to a river, management within the riparian zone will differ from the remainder of the stand. There are four uncommon wetland and riparian forest types that do not fit neatly within the six forest ecosystem types (see Appendix 2). These should be classified separately.

**Table 1. Forest Ecosystem Types and Special-Value Habitats for Focus Species Management**

| <b>Focus Species Habitat Classification</b> | <b>Brief Description</b><br>(See habitat management guides in Section 5 for more detailed descriptions.)                                            |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Forest Ecosystems</b>                    |                                                                                                                                                     |
| Aspen-Birch                                 | Aspen and/or paper birch are the dominant species                                                                                                   |
| Northern Hardwoods                          | Various mixes of sugar maple, beech and yellow birch are dominant; mixedwood stands may include up to 50% hemlock, red spruce, or balsam fir        |
| Oak-Pine                                    | Includes stands ranging from pure oak to pure white pine as well as mixes with red maple, hemlock, or northern hardwoods                            |
| Hemlock                                     | Stands with >50% hemlock dominance                                                                                                                  |
| Spruce-Fir                                  | Stands ranging from pure red spruce and/or white spruce to pure balsam fir, sometimes with a significant white pine, hemlock, or hardwood component |
| Northern White Cedar                        | Includes both northern white cedar swamps found in level basins or cedar-spruce seepage forests on gentle slopes                                    |
| <b>Special-value Habitats</b>               |                                                                                                                                                     |
| Riparian and Wetland Forest                 | Forests adjacent to intermittent and perennial streams, rivers, lakes and coastal waters as well as wetland forests                                 |
| Vernal Pool                                 | Fishless seasonal pools or small ponds that provide breeding habitat for wood frogs, yellow or blue-spotted salamanders, or fairy shrimp            |

## Classifying Stands into Development Stages

After a severe stand-replacing disturbance such as fire or clearcutting, forest stands frequently undergo a somewhat predictable pattern of development that begins with small seedlings and, absent another severe disturbance, culminates in old growth after 150 or more years. Different wildlife species favor different development stages.

Many of the species targeted by focus species management can be grouped into those that inhabit young forests—seedling and sapling stands—or those that inhabit relatively mature, mature, or late-successional forests. While most plants and animals in the northeast seem to be found in young or mature forests, research has found that several species of lichens (e.g., Selva 1994) are uniquely associated with late-successional or old-growth forests.

Focus species management does not mean recreating the pre-European forest. However, it does mean maintaining sufficient habitat so that healthy populations of all species can be sustained. Fortunately, the vast majority of species that we know of are compatible with forest management as long as the proper conditions are maintained. Research to date indicates that all vertebrates can be maintained within the range of development stages created by forestry operations that grow trees to large sawtimber size classes. However, there are mounting concerns that the rapid



loss of late-successional forest threatens certain lichens (Hagan and Whitman 2003) and potentially species in other groups, such as insects or other invertebrates.

### **Using Typical Stand Classifications to Estimate Development Stage**

A common classification system is as follows:

|                 |                                           |
|-----------------|-------------------------------------------|
| Cover type:     | S = Softwood, M = Mixedwood, H = Hardwood |
| Height:         | 1 = <30 ft., 2 = 30-60 ft., 3 = >60 ft.   |
| Canopy closure: | A = >67%, B = 33-67%, C = <33%            |

#### **Recommendations:**

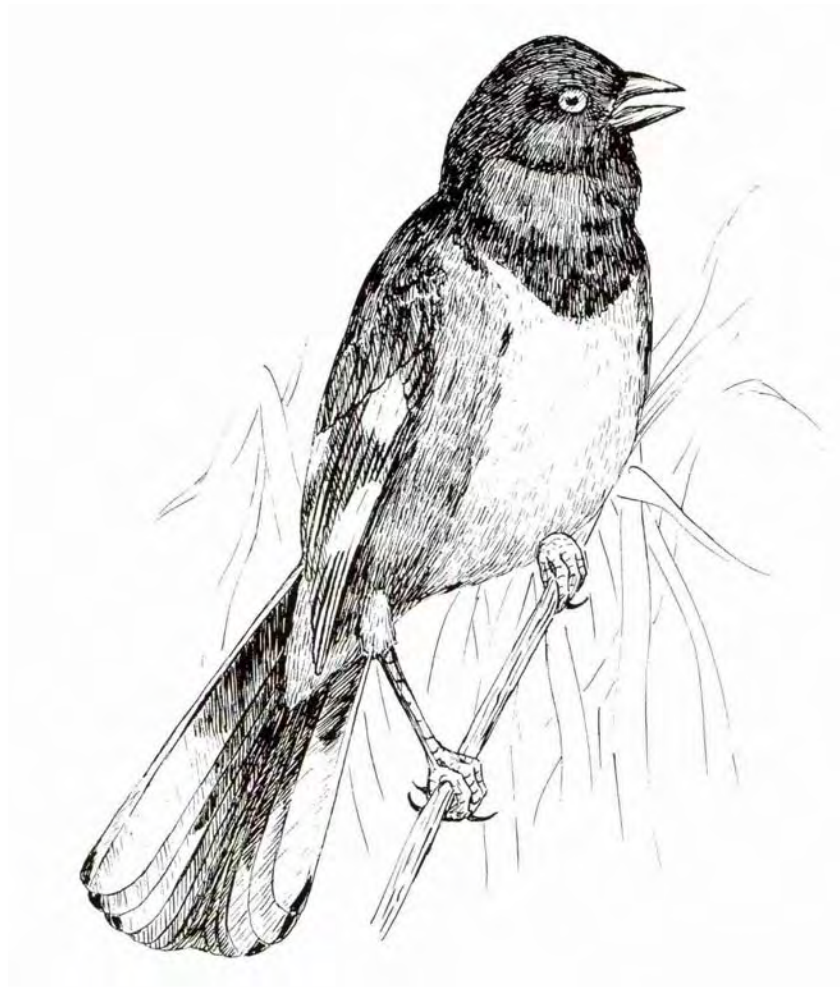
- ✓ Tree species information is necessary to place a stand in one of the six ecosystem types.
- ✓ Information on seedlings and saplings is necessary to classify some stands, for example an “S3A” may be a stand of residual sawtimber with young regeneration that should be classified as early successional or intermediate using the focus species classification system.
- ✓ Inventory tree regeneration and trees 1-4 in. dbh (diameter at breast height) as well as trees over that size. This information will provide useful information on the ecological characteristics and future composition of the stand. Depending on how the data will be used, plot measurements or an “ocular estimate” may be used. An ocular estimate (e.g., a field estimate of the percent cover in seedlings and saplings of different species) may be sufficient for helping to determining forest ecosystem and development stage, but plot measurements are better for long-term monitoring.
- ✓ Stand maps with both canopy and understory layers classified will help interpret inventory information for focus species management.
- ✓ Combine aerial-photo information with stand-specific cruise data for the best results.

**Table 2. Stand Development Stages**

| Stand Development Stage |                            | Identification                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                            | Typical characteristics <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Early Successional      | Regeneration and Seedlings | Less than 30 sq.ft. basal area/ac. (BA) in trees >1 in. dbh.<br>Typically 0-10 years                                                                                                                                                                                                                                                                                                                              | Regeneration phase; may include partial residual overstory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                         | Saplings and Small Poles   | BA in trees 1-5 in. dbh greater than that of trees <1 in. or >5 in.<br>Typically 10-30 years old                                                                                                                                                                                                                                                                                                                  | Young, closed-canopy stands or two-storied stands dominated by small trees with a partial residual overstory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Intermediate            |                            | Majority of stocking in: <ul style="list-style-type: none"> <li>Softwood stands: &gt;5 in.</li> <li>Hardwood stands &gt;5 in.</li> </ul> Majority of stocking typically in trees 30-70 years old                                                                                                                                                                                                                  | Includes even-aged stem-exclusion stands (little or no understory) and two-story stands with partial overstory of mature trees                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Mature                  |                            | Majority of stocking in <ul style="list-style-type: none"> <li>Spruce-fir &gt;9 in.</li> <li>Hardwoods &gt;12 in.</li> <li>Pine-hemlock &gt;12 in.</li> </ul> Overstory typically 70-100+ years depending on forest type                                                                                                                                                                                          | Includes stands dominated by small- to large-sized sawtimber, including stands in the late stem exclusion stage and early phases of understory reinitiation. May be single story, two story, or multi story depending on past harvest history. Depending on species and condition, may be maintained by individual tree or group-selection harvests.                                                                                                                                                                                                                                                                      |
| Late-Successional       |                            | Majority of stocking (better site quality, will vary with species, site, and stand history): <ul style="list-style-type: none"> <li>Spruce-fir ≥12 in.</li> <li>Hardwoods ≥16 in.</li> <li>Pine-hemlock ≥20 in.</li> <li>Large deadwood accumulating</li> <li>Indicator species (e.g., certain lichens) present</li> </ul> Transition from mature to late successional is generally in the 100-125-year age range | Net growth stable or declining in unharvested stands; principle mortality in canopy due to disease, wind, and insects. Large-diameter dead wood accumulating in standing trees and on the ground. Typically one or more age classes represented in the understory or in gaps but may be virtually even-aged in the case of pine and hemlock. When long-lived species with medium to high shade tolerance are present, this stage can be maintained over time by light individual-tree or group-selection management. Stands meeting diameter guidelines but lacking other characteristics should be classified at mature. |
|                         | Old-Growth                 | Generally >150 years old                                                                                                                                                                                                                                                                                                                                                                                          | Old growth is the culmination of the late-successional stage. These stands are typically unharvested or have a very light harvest history.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

<sup>1</sup> Diameters and ages are general guidelines only and will vary based on site characteristics, stand history, and forest type. Note that diameter guidelines are overlapping; place stand in the oldest development stage possible given the diameter constraints and other characteristics. Final determination should be based on professional judgment based on stand conditions and knowledge of local forests. See Appendix 10 for example of stand classification.





*Eastern Towhee (credit: U.S. Fish and Wildlife Service)*

## 5. Habitat Management Guides

The following pages include management guides for the six forest ecosystems and special-value habitats used in focus species forestry. Each habitat guide describes typical identifying characteristics, ecology, and wildlife<sup>2</sup>.

### Focus Species List

The focus species lists for each habitat type are divided into three development stages: early successional forest, mature forest, and late-successional forest. See Table 2 for a definition of these development stages. By focusing on both ends of the forest maturity spectrum, habitat specialists that require young or old forests are accommodated as well as the great number of species that live in a broad range of development stages. Following are some notes on the species lists in the habitat management guides:

- There are no late-successional species for aspen-birch because this is a short-lived stand type that does not develop true late-successional characteristics.
- There are no early successional focus species listed for eastern hemlock or northern white cedar. Due to the limited extent of these ecosystems, their great value as mature conifer cover, and the potential for rare plants in cedar-seepage forests, the recommendations focus on maintaining habitat associated with mature or late-successional phases of these stands.
- Most research on late-successional species (mostly lichens) has been associated with northern hardwood, spruce-fir, and northern pine (i.e., not oak-pine) types. Little is known about other types, but a conservative approach to management suggests allowing some stands of all types to reach the late-successional stage.

### Focus Species Management

This section describes natural disturbance regimes (fire, insects, disease, etc.) for each forest type and the silvicultural tools that can be used to create and maintain focus species habitat. Focus species forestry does not attempt to “mimic” the time scales of natural disturbance because even under the most conservative management trees are harvested much more frequently than they would die under natural conditions. However, natural disturbance regimes can be used to inform and help guide forest management, especially by modifying silviculture to produce stand and landscape structures that are found in natural, unmanaged forests. Refer to Appendix 3 for an overview of silvicultural systems.

The management recommendations in the following section should be implemented in the context of the stand-level management guidelines (Section 7), the landscape-scale forestry guide (Section 8), and the recommendations for focus species associated with that habitat type.

---

<sup>2</sup> “New England Wildlife: Habitat, Natural History and Distribution” by Richard DeGraaf and Mariko Yamasaki (2001) provides a comprehensive review of wildlife associated with the region’s forest ecosystems.



# Aspen-Birch

## Identification

Aspen-Birch forests are post-disturbance communities typically characterized by paper birch, bigtooth aspen, and trembling aspen. Depending on the region of the state and soils, associated species may include red maple, red oak, red spruce, yellow birch, sugar maple, and white pine.

## Ecology

This relatively short-lived (less than 100 years) early successional forest type is dominated by shade-intolerant species that typically become established after severe disturbances such as fire or clearcutting and other forms of heavy harvests. Aspen-birch typically occurs in large patches up to several hundred acres that reflect past disturbance. On better soils this type is likely to be replaced over time by northern hardwoods. On cool and/or moist sites at high elevations or in lowlands, succession will tend towards spruce-fir.

## Wildlife

Due to structural similarity and landscape proximity, aspen-birch forests support many of the same species as northern hardwoods in similar development stages. Depending on the time of year, ruffed grouse will use seedling, sapling, or mature stands, and aspen is the beaver’s preferred food. Young aspen-birch forests are also used by woodcock for feeding and brood cover. Both aspen and birch are prone to internal decay and hence make excellent but short-lived cavity trees.



| Rare Species             |
|--------------------------|
| None                     |
| Rare Natural Communities |
| None                     |

| Focus Species                                                         |                                   |
|-----------------------------------------------------------------------|-----------------------------------|
| Early Successional Forest                                             | Mature Forest                     |
| Snowshoe hare <sup>1</sup><br>Ruffed grouse<br>Chestnut-sided warbler | Northern goshawk<br>Ruffed grouse |

<sup>1</sup>Conifer understory present

| Focus Species Management                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b>                                     | Even-aged management is generally recommended to maintain aspen-birch forests. Alternately, landowner objectives or landscape analysis may suggest that encouraging natural succession to take place is the preferred option. When present, aspen-birch is an excellent type for developing and maintaining early successional habitat. Aspen regenerates by root suckering, while wind-blown seed is the primary method of birch regeneration. An irregular harvest that leaves unharvested patches and individual trees of long-lived species will emulate natural disturbances better than traditional even-aged management.                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Single-tree and Group Selection</b>              | <ul style="list-style-type: none"> <li>✓ Avoid single-tree selection if the goal is to maintain aspen-birch.</li> <li>✓ Large-group selection will sustain these species, but there will be an increasing component of more shade-tolerant species over time.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Shelterwood, Small Patch Cuts, and Clearcuts</b> | <ul style="list-style-type: none"> <li>✓ Small patch cuts (2-5 acres), seed-tree cuts, or clearcuts are the best for regenerating aspen-birch and providing the dense regeneration preferred by ruffed grouse and woodcock. Shelterwood may result in excessive birch mortality and discourage root suckering of aspen.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Other</b>                                        | <ul style="list-style-type: none"> <li>✓ Refer to landscape-scale guidelines (Section 8). Use the amount of aspen-birch in the landscape and the amount of other early successional hardwoods to help decide whether to maintain aspen-birch or encourage succession to another type.</li> <li>✓ Soil scarification is important for birch regeneration.</li> <li>✓ Older declining aspen clones may not sprout well.</li> <li>✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level recommendations (Section 7).</li> <li>✓ If the goal is to encourage succession, on better sites northern hardwoods can be favored by thinning and eventually released by removing part or all of the overstory. On poorer sites spruce and fir, which often become established in the understory, may be released as the aspen and birch mature.</li> <li>✓ Try to maintain aspen inclusions in other forest types near riparian areas where beaver may be present.</li> </ul> |

**References:** DeGraaf et al. 1992, Degraaf and Yamasaki 2001, Elliott 1999, Eyre 1980, Marquis et al. 1969, Perala D. 1977



# Northern Hardwoods

## Identification

Sugar maple, yellow birch, and American beech are the characteristic species. Paper birch, aspen, red oak, hemlock, and red spruce are common associates. On poor sites beech and red maple may be dominant, while sugar maple, ash, and basswood are found on highly enriched sites. Stands range from pure hardwood to mixed hardwood-conifer. This type is known for an abundance of spring wildflowers.

## Ecology

Northern hardwood forests are typically found on moist, medium- to well-drained sites at middle elevations in western, northern, and eastern Maine. Over time this late-successional type forms large, relatively stable forests. Under natural conditions, shade-tolerant northern hardwoods are most commonly regenerated in small gaps created by windthrow or mortality due to insects and disease. There is often a transition to spruce-fir at high elevations. Mixed hardwood-conifer stands are common on sites with intermediate site quality at lower elevations.

## Wildlife

Northern hardwoods host a great variety of resident and migrant songbirds that are uniquely adapted to different ages of forest as well as different positions (ground, understory, or canopy) within the forest. Beech nuts are critical to reproductive success of black bear in northern Maine. Because of their extent—about 6 million acres in Maine—northern hardwoods are one of Maine’s most important forest habitats.



### Rare Species

17 rare plants are associated with this ecosystem, most frequently in enriched hardwoods

### Rare Natural Communities

Maple-basswood-ash forest (also known as enriched hardwood forest)

| Focus Species                                                         |                                                                                                                                                                                                     |                                               |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Early Successional Forest                                             | Mature Forest                                                                                                                                                                                       | Late-successional Forest                      |
| Chestnut-sided warbler<br>Snowshoe hare <sup>1</sup><br>Ruffed grouse | Fisher (South region)<br>American marten (North region)<br>Northern goshawk<br>Pileated woodpecker<br>Barred owl<br>Wood thrush (South region)<br>Black-throated-blue warbler<br>Redback salamander | Lungwort lichen ( <i>Lobaria pulmonaria</i> ) |

<sup>1</sup>conifer understory present

# Northern Hardwoods

| Focus Species Management        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b>                 | Northern hardwoods are adaptable to a wide range of silvicultural practices. The natural community characteristics of northern hardwoods are best maintained by single-tree or group selection cutting, while heavier cuts may be used for specific timber and wildlife objectives.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Single Tree Selection</b>    | <ul style="list-style-type: none"> <li>✓ Well suited to maintaining mature forest and consistent with natural disturbance patterns.</li> <li>✓ May be used with caution in maple-basswood-ash forest (a rare natural community)—avoid soil disturbance and maintain &gt;60% overstory canopy closure.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Group Selection</b>          | <ul style="list-style-type: none"> <li>✓ Use to maintain mature forest while encouraging mid-tolerant species like yellow birch and ash and creating small patches (up to 2 acres) of early successional habitat.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Shelterwood and Clearcut</b> | <ul style="list-style-type: none"> <li>✓ Use to create patches of early successional habitat over 2 acres in size and to regenerate intolerant species or low-quality stands.</li> <li>✓ Retain patches of mature stands in islands or peninsulas as well as travel corridors. See stand-level guidelines for details (Section 7).</li> <li>✓ Return tree tops to the harvest area to prevent nutrient depletion and maintain soil structure.</li> <li>✓ Shelterwood harvests can be used to emulate extreme natural disturbances; lengthening the period before overstory removal will minimize impacts to herbaceous plants.</li> <li>✓ Clearcuts have no true natural analogue and require a longer time for ecosystem recovery.</li> <li>✓ When clearcuts and shelterwood are used, long rotations (&gt;100 years) may be necessary to restore mature forest conditions.</li> </ul> |
| <b>Other</b>                    | <ul style="list-style-type: none"> <li>✓ Maintain nut-producing oak and beech. Where healthy beech are not present, even trees with partial live crowns are beneficial to bears and other wildlife.</li> <li>✓ Maintain inclusions of hemlock, spruce, and other conifers.</li> <li>✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7).</li> <li>✓ Refer to landscape-level guidelines for recommendations on integrating landscape structure and design into stand level-decisions (Section 8).</li> </ul>                                                                                                                                                                                                                                                                                                       |

**Mixed Northern Hardwood-Spruce-Fir Forests:** In general, for mixedwood stands up to 1/3 spruce-fir and other softwoods, use the northern hardwood recommendations; for mixedwood stands with 1/3 to 2/3 in conifers, consider both the northern hardwood and spruce-fir recommendations; for mixedwood with more than 2/3 in conifers, use the spruce-fir recommendations.

**References:** Carlson 1999 (see Section II, Enriched Hardwood Forests), DeGraaf et al. 1992, DeGraaf and Yamasaki 2001, Flatebo et al. 1999, Eyre 1980, Leak et al. 1987, MNAP 2001, Seymour 1984, Solomon et al. 1995



# Oak-Pine

## Identification

Northern red oak and white pine are the characteristic species of this ecosystem, which includes stands ranging from pure oak to pure pine. Common associates include red maple, white ash, eastern hemlock, paper and yellow birch, sugar maple, and beech. Beyond the range where red oak is common, white pine-mixed northern conifer forests should be considered part of the spruce-fir ecosystem.

## Ecology

Oak-pine reaches its northern range limit in central Maine and on south-facing slopes in Washington County. Most of the sites where this ecosystem is found were cleared in the 17th and 18th centuries for fields or pasture. Stands dominated by white pine are found on sites that were most recently fields and on well-drained to excessively drained sand and gravel. The driest sites tend towards pitch pine in the southwest or red pine further north. Red maple increases with soil moisture. Under natural conditions, stand-replacing disturbances caused by fire or wind may have been instrumental in maintaining oak-pine forests. Burning by Native Americans may have also played a role in maintaining this type. Gray squirrels aid regeneration by burying acorns, which if not recovered, will sprout the following spring.



## Wildlife

Oak-pine forests are the primary forested wildlife habitat in many parts of southern and central Maine. Acorns are a key food for deer, bear, wild turkey, and many other species. Large blocks of oak-pine forest are important to species such as black bear, fisher, northern goshawk, wood thrush, and scarlet tanager.

### Rare Species

14 rare plants  
Many rare insects associated with pitch pine, red pine, and jack pine

### Rare Natural Communities

White oak-red oak forest

| Focus Species                                             |                                                                                                                      |                                                    |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Early Sucessional Forest                                  | Mature Forest                                                                                                        | Late-successional Forest                           |
| Ruffed grouse<br>Chestnut-sided warbler<br>Eastern towhee | Fisher<br>Northern goshawk<br>Pileated woodpecker<br>Barred owl<br>Wood thrush<br>Pine warbler<br>Redback salamander | No species currently known due to limited research |

| Focus Species Management                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b>                                     | Obtaining adequate regeneration in oak-pine forests usually requires some form of shelterwood management or group-selection harvesting. In the case of white pine, timing harvests to coincide with an abundant seed year is recommended, while maintaining partial shade through the sapling phase is important to minimize weevil damage. In mixed oak-pine stands, white pine regenerates well, due in part to the light shade offered by oak canopies and perhaps the digging action of gray squirrels. On moist and rich soils, where red maple and hemlock tend to be more aggressive, maintaining pine or oak dominance may be impossible.                                                                                                          |
| <b>Single-tree and Group Selection</b>              | <ul style="list-style-type: none"> <li>✓ Light single-tree selection is unlikely to maintain oak-pine except on very dry sites.</li> <li>✓ Crop-tree management (see Appendix 3) focusing on the best trees combined with group selection may be used to maintain mature forest conditions. Locate groups where there are patches of advanced regeneration. Large groups will provide small patches of early successional habitat.</li> </ul>                                                                                                                                                                                                                                                                                                              |
| <b>Shelterwood, Small Patch Cuts, and Clearcuts</b> | <ul style="list-style-type: none"> <li>✓ The shelterwood system is probably the best method for regenerating and cultivating oak-pine. A regeneration harvest should occur approximately 30 years before crop trees are expected to mature. When regeneration is established, maintain the overstory below 40% crown cover to discourage shade-tolerant competitors but provide enough shade to limit pine weevil damage. A heavy shelterwood cut will also provide habitat for early successional species.</li> <li>✓ Patch cuts (2-5 acres) and occasional small clearcuts will provide ideal nesting habitat for young-forest birds and browse for hare, rabbits, and deer. Low-value stands may be a good opportunity to use this approach.</li> </ul> |
| <b>Other</b>                                        | <ul style="list-style-type: none"> <li>✓ Maintain and encourage oak mast trees for bear, deer, turkey, squirrels, and mice.</li> <li>✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7).</li> <li>✓ Refer to landscape-level guidelines (Section 8).</li> <li>✓ Mature hemlock is often indicative of sites that were not cleared for crops or permanent pasture. These sites add plant and wildlife diversity to the forest and should be maintained in a mixed-species composition if possible.</li> </ul>                                                                                                                                                                         |

**References:** DeGraaf et al. 1992, DeGraaf and Yamasaki 2001, Flatebo et al. 1999, Lancaster et al. 1978, Sampson et al. 1983, Seymour 1994



# Eastern Hemlock

## Identification

Eastern hemlock in pure or mixed stands is the dominant species. Depending on the region of the state and surrounding forest type, associates may include red oak, white pine, birches, maples, spruce, cedar, or fir.

## Ecology

Eastern hemlock typically occurs in patches of 50 acres or less within oak-pine, northern hardwood, and spruce-fir ecosystems. The hemlock wooly adelgid, an exotic insect that has devastated hemlock forests from Appalachia to central Massachusetts, has now spread into southern Maine.

## Wildlife

Hemlock provides important food, cover, and nesting habitat for many species. Black bears use hemlock for denning and cubs climb them for escape cover. Hemlock stands provide important deer wintering cover in much of the Northeast. Blackburnian and black-throated green warblers are strongly associated with hemlock in mixed hemlock-hardwood forests.



| Rare Species             |
|--------------------------|
| None                     |
| Rare Natural Communities |
| None                     |

| Focus Species                                                                                                                                                         |                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Mature Forest                                                                                                                                                         | Late-successional Forest                           |
| American marten (North region)<br>Fisher (South region)<br>White-tailed deer (North region)<br>Pileated woodpecker<br>Barred owl<br>Wood thrush<br>Redback salamander | No species currently known due to limited research |

# Eastern Hemlock

| Focus Species Management               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b>                        | Hemlock's greatest wildlife value is as a mature forest component of the landscape. Its deep crown provides excellent cover while frequent and profuse cone crops provide abundant food for many birds and small mammals. Management should strive to maintain stands in a mature condition through periodic light regeneration harvests. Individual trees and groups within northern hardwoods and oak-pine provide important food and cover and should be maintained and encouraged. Hemlock regenerates best on partly shaded, scarified soil. |
| <b>Single-tree and Group Selection</b> | <ul style="list-style-type: none"> <li>✓ Both approaches are well suited to maintaining mature forest conditions and are consistent with natural disturbance patterns.</li> <li>✓ Small-group selection (0.1 acre or less) can be used to regenerate hemlock while creating within-stand patchiness.</li> </ul>                                                                                                                                                                                                                                   |
| <b>Shelterwood and Clearcut</b>        | <ul style="list-style-type: none"> <li>✓ Researchers recommend a 2- or 3-stage shelterwood with 70-80% canopy cover with scattered gaps.</li> <li>✓ If the shelterwood system is used, be sure to retain the overstory in a two-aged system or maintain mature hemlock cover nearby.</li> <li>✓ Clearcutting is not recommended in hemlock forests.</li> </ul>                                                                                                                                                                                    |
| <b>Other</b>                           | <ul style="list-style-type: none"> <li>✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7).</li> <li>✓ Maintain hemlock inclusions in other forest types. In northern Maine it is not uncommon to find old-growth legacy trees in excess of 200 years old.</li> <li>✓ Refer to landscape-level guidelines (Section 8). Use hemlock stands to help build and maintain mature and late-successional components of the landscape.</li> </ul>                                    |

**References:** Carey 1993, DeGraaf et al. 1992, DeGraaf and Yamasaki 2001, Eyre 1980, Flatebo et al. 1999, Goerlich and Nyland 2000, Kenefic and Seymour 1999, U.S. Forest Service and Vermont Agency of Environmental Conservation 1973



# Spruce-Fir

## Identification

Spruce-fir forests are typically characterized by mixtures of red spruce or white spruce and balsam fir in pure stands or with other species. Common associates include yellow birch, paper birch, and other northern hardwood species as well as hemlock, northern white cedar, and black spruce. White pine in the spruce-fir/northern hardwood landscapes of northern or eastern Maine is included in the spruce-fir ecosystem for the purposes of Focus Species Forestry.

## Ecology

Spruce-fir forests frequently share the same landscape as northern hardwoods, but are found on cooler sites—notably valley bottoms and high-elevation areas, and in a narrow band along the coast—or where soils are somewhat-poorly to poorly drained. Transitional stands may contain up to 50% hardwoods. The Maine Natural Areas Program recognizes 6 spruce-fir subtypes (see Appendix B). Stands dominated by white spruce are common on former agricultural land in northern and eastern Maine as well as in the spray zone on coastal islands.

## Wildlife

Several species—including spruce grouse, gray jay, black-backed woodpecker, and bay-breasted, magnolia and Cape May warblers—are found almost exclusively in spruce-fir forests. Marten are strongly associated with this type, either in pure stands or in mixed hardwood-spruce-fir forests. Young spruce-fir is critical for snowshoe hare. Relatively mature to mature stands are critical deer wintering areas in northern Maine.



| Rare Species                                                                                          |
|-------------------------------------------------------------------------------------------------------|
| Canada lynx<br>Bicknell's thrush (limited to fir-heartleaved birch subalpine forest)<br>9 rare plants |
| Rare Natural Communities                                                                              |
| Fir-heartleaved birch subalpine forest                                                                |

| Focus Species                     |                                                                                                                                              |                                                     |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| Early Successional Forest         | Mature Forest                                                                                                                                | Late-successional Forest                            |
| Snowshoe hare<br>Magnolia warbler | American marten (North region)<br>Fisher (South Region)<br>White-tailed deer (North region)<br>Black-backed woodpecker<br>Redback salamander | Gray horsehair lichen ( <i>Bryoria capillaris</i> ) |

| Focus Species Management                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b>                              | Under natural conditions, disturbances that lead to regeneration vary by site and location. Spruce budworm and spruce bark beetle cause severe mortality on a cyclical basis, and blowdowns are not uncommon on coastal islands, high-elevation sites, and exposed sites with a high water table. Large stand-replacing disturbances may occur, but partial canopy loss in small to large patches is more common. On sites with a northern hardwood or hemlock component, regeneration is more likely to occur in smaller canopy gaps. Disturbance frequency increases with the percent of fir, soil moisture, or exposure to wind. On better sites spruce stands will easily persist more than 200 years.                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Single-tree and Group Selection</b>       | ✓ Single-tree or group-selection harvests emulate the natural disturbance patterns of better-drained spruce-fir sites where mixed spruce-northern hardwood stands are found.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Shelterwood, Patch Cuts, and Clearcut</b> | <ul style="list-style-type: none"> <li>✓ An irregular shelterwood system with reserve trees and patches resulting in a two-aged stand will mimic the cyclical natural disturbance pattern frequently found on poorer-quality sites that are naturally dominated by spruce-fir. Use this approach to create and maintain abundant browse and cover needed by snowshoe hare (see species profile, Section 6), critical prey for bobcat and the threatened Canada lynx. Moose, magnolia warblers, spruce grouse, ruffed grouse, and other young-forest species will also benefit. Optimum hare browse is found in dense regeneration that is 5-20 years old.</li> <li>✓ True clearcuts are less appropriate for maintaining the natural forest community because they create excessive competition from hardwoods and raspberries, which adversely impacts spruce-fir regeneration and ground cover.</li> <li>✓ Where management objectives result in complete overstory removal in the shelterwood or clearcut system, leave "islands" of reserve trees. See stand-level guidelines (Section 7).</li> </ul> |
| <b>Other</b>                                 | <ul style="list-style-type: none"> <li>✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7).</li> <li>✓ Favor spruce over fir in intermediate thinnings and harvests. Increasing the percentage of spruce will decrease susceptibility to spruce budworm, which prefers fir, and the longer life span of spruce will allow more management flexibility.</li> <li>✓ See guide to landscape-scale forestry (Section 8) and guidelines for American marten (Section 6).</li> <li>✓ In northwestern Maine where lynx may be found, check with the Maine Department of Inland Fisheries and Wildlife (MDIFW).</li> <li>✓ In northern and eastern Maine, work with MDIFW to develop a long-term plan for managing deer wintering areas.</li> </ul>                                                                                                                                                                                                                                                                                          |

**Mixed Spruce-Fir Northern Hardwood Forests:** In general, for mixedwood stands up to 1/3 spruce-fir and other softwoods, use the northern hardwood recommendations; for mixedwood stands with 1/3 to 2/3 in conifers, consider both the northern hardwood and spruce-fir recommendations; for mixedwood with more than 2/3 in conifers, use the spruce-fir recommendations.

**References** Carlson 1999 (see Section II, Enriched Hardwood Forests); DeGraaf et al. 1992; DeGraaf and Yamasaki 2001; Eyre 1980; Flatebo et al. 1999; Frank and Bjorkbom 1973; Fuller and Harrison 2000; Koehler and Brittell 1990; MNAP 2001; Payer and Harrison 2000a, 2000b, 2003; Seymour 1994



# Northern White Cedar

## Identification

Northern white cedar is the characteristic species in this ecosystem. Red spruce is a common associate that may be dominant or co-dominant in cedar-spruce seepage forests. Black spruce is more likely to be found in northern white cedar swamps. Other common species include balsam fir, red maple, yellow birch, and white pine. Atlantic white cedar swamps are superficially similar but are quite rare in Maine, occurring in fewer than 10 coastal locations.

## Ecology

Cedar-spruce seepage forests are typically located on gentle slopes with groundwater discharge. Cedar swamps are located in nearly flat basins with organic peat accumulation. Northern white cedar swamps and seeps can be found throughout the state, but tend to be most common and extensive in the north where they occur in large patches up to several hundred acres in size. Neutral to alkaline conditions, when present, provide habitat for a number of rare plants. Northern white cedar is tolerant to very tolerant of shade, is long-lived, and tends to form relatively stable, persistent communities. In the absence of heavy deer browsing it regenerates well in small gaps but also will become re-established after wildfire or heavy logging. Patch size typically ranges from 5-200 acres.

## Wildlife

Northern white cedar and spruce-fir forests have similar “northern conifer” wildlife communities that include a wide range of resident and migratory species. Northern white cedar provides critical food and cover to wintering deer in eastern and northern Maine.



| Rare Species                                                        |
|---------------------------------------------------------------------|
| 17 rare plants                                                      |
| Rare Natural Communities                                            |
| Cedar-spruce seepage forests ranked S-3 (<100 occurrences in Maine) |

| Focus Species                                                                               |                                                    |
|---------------------------------------------------------------------------------------------|----------------------------------------------------|
| Mature Forest                                                                               | Late Successional Forest                           |
| Snowshoe hare<br>White-tailed deer (North region)<br>Black-backed woodpecker (North region) | No species currently known due to limited research |

# Northern White Cedar

| Focus Species Management                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Overview</b>                                     | Northern white cedar reproduces well by seed or by layering on organic soils. It is shade-tolerant but responds well to release at nearly any age and can be managed with both uneven-aged or even-aged methods. Quality and growth are best in mixed-species stands on better quality sites (cedar-spruce seepage forests). Given the importance of this ecosystem to rare plants and wintering deer, management that focuses on maintaining a relatively high percent of canopy cover and relatively mature to mature forest conditions is desirable. Both group selection and shelterwood harvests that meet state guidelines for managing deer wintering areas should be considered a starting point for harvest planning.                                                                                                                                |
| <b>Single-tree and Group Selection</b>              | ✓ Single-tree and small-group selection are best for maintaining cedar and associated plant and wildlife habitat.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Shelterwood, Small Patch Cuts, and Clearcuts</b> | <ul style="list-style-type: none"> <li>✓ Shelterwood management in a two-aged system with reserve trees is also likely to produce good results but should be used with caution if rare plants are present.</li> <li>✓ Patch cuts may release advanced regeneration and provide good browse but will be more harmful to any rare plants that may be present.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Other</b>                                        | <ul style="list-style-type: none"> <li>✓ If possible, survey sites for rare plants prior to harvest. Use relatively light partial harvests to maintain shading, and harvest in winter to minimize site disturbance. Consider permanent protection for undisturbed sites with concentrations of rare plants.</li> <li>✓ Avoid building roads in cedar swamps and seeps if possible. Otherwise, design drainage to ensure that water does not back up and kill trees and other plants.</li> <li>✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7).</li> <li>✓ Refer to landscape-level guidelines (Section 8). Use northern white cedar stands as a mature forest component in landscape plans based on habitat needs of the American marten and wintering white-tailed deer.</li> </ul> |

**References:** DeGraaf et al. 1992, Flatebo et al. 1999, Johnston 1977



# Riparian and Wetland Forest

## Identification

Riparian and wetland forests as defined here include forests that contain or are adjacent to seasonal or permanent standing water, including small pools, seeps, intermittent and perennial streams, rivers, ponds, lakes and coastal waters. Forest types may include wetland and floodplain communities as well as upland forest ecosystems described in this manual (e.g. oak-pine, northern hardwoods, spruce-fir) that border rivers, streams, and lakes.



## Ecology

Riparian and wetland forests provide several major functions, including minimizing downstream flooding, filtering runoff and protecting water quality, maintaining cool water temperatures for fish, providing the energy for the base of the aquatic food web in the form of fallen leaves, and providing logs that create cover for fish and invertebrates and a substrate for aquatic algae.

## Wildlife

These forests support an unusually high concentration of animals that includes tree-nesting waterfowl (wood duck, common goldeneye, hooded merganser, and common merganser) and other birds, as well as aquatic and semi-aquatic animals such as beaver, otter, mink, and moose. Large pines provide important nesting and loafing sites for bald eagle and osprey. Upland mammals such as deer, bobcat, coyote, and bats frequently use shorelands for denning, travel corridors, and feeding zones. In southern Maine's developing landscape, wetland and shoreland forests often form the nucleus of large forest blocks and a network of travel corridors that are critical to many species. Up to 80% of Maine's vertebrate wildlife species use riparian habitat during some or all of their life cycle.

| Rare Species                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bald eagle, Blanding's turtle, spotted turtle, box turtle, Atlantic salmon, bald eagle<br>More than 20 rare plants, 4 insects, 2 freshwater mussels and 1 fish |
| Rare Natural Communities                                                                                                                                       |
| Hardwood river terrace, hardwood seepage forest, silver maple floodplain forest, cedar-spruce seepage forest                                                   |

| Focus Species <sup>1</sup>                                                                                       |
|------------------------------------------------------------------------------------------------------------------|
| Beaver<br>Pileated woodpecker<br>Northern waterthrush<br>Wood turtle<br>Northern dusky salamander<br>Brook trout |

<sup>1</sup> Focus species vary with water body type. See management table on following page.

# Riparian and Wetland Forest

| Focus Species Management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Body                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Width (ft.)         | Focus Species/<br>Primary Management Goals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Seeps, intermittent streams                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ≤75                 | <b>Focus Species:</b> Northern dusky salamander<br><b>Management Goals:</b> <ul style="list-style-type: none"><li>• Protect water quality by avoiding soil disturbance and sediment runoff.</li><li>• Maintain shade along stream channel.</li></ul>                                                                                                                                                                                                                                                                                                               |
| Small- to medium-sized perennial streams (first- and second-order streams) <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 75-250 <sup>2</sup> | <b>Focus Species:</b> All<br><b>Management Goals:</b> <ul style="list-style-type: none"><li>• Protect water quality and maintain shade.</li><li>• Manage for large snags and cavity trees.</li></ul>                                                                                                                                                                                                                                                                                                                                                               |
| Large streams and rivers (third- and fourth-order streams) <sup>1</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ≥250                | <b>Focus Species:</b><br>Freshwater: All except dusky salamander<br>Coastal waters: Pileated woodpecker only<br><b>Management Goals:</b> <ul style="list-style-type: none"><li>• Protect water quality and maintain shade.</li><li>• Manage for large snags and cavity trees.</li><li>• Maintain large pines for eagle and osprey nest and roost trees adjacent to rivers, ponds &gt;10 acres, and coastal waters.</li><li>• Buffers in excess of 75 ft. provide wildlife travel corridors and buffer aquatic wildlife from human activities in uplands.</li></ul> |
| Ponds and non-forested wetlands <10 acres                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 75-100              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Ponds and non-forested wetlands >10 acres; coastal waters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ≥250                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Recommendations:</b> <ul style="list-style-type: none"><li>✓ Always apply appropriate Best Management Practices (BMPs)<sup>3</sup> to control erosion and sediment.</li><li>✓ Modify timber management as needed to achieve riparian management goals (column 3).</li><li>✓ Use single-tree selection to maintain 65-70% crown closure within 75 ft. of the water body or wetland edge. For wider zones, small-group group selection (up to quarter-acre openings) beyond 75 ft. may be appropriate.</li><li>✓ Maintain an uncut buffer up to one tree height in width or leave trees that will eventually fall into the stream to provide structure for fish and aquatic insects.</li><li>✓ Refer to BMP handbook for buffer zone widths on slopes over 30%. Greater width may be required to include seeps, forested wetlands, and floodplains adjacent to water bodies.</li><li>✓ Wider buffer zone widths are beneficial when large, heavily harvested areas abut riparian areas. Some regional guidelines recommend riparian management zones up to 600 ft. on fourth-order streams.</li><li>✓ Flag seeps and intermittent streams before snowfall.</li><li>✓ Follow recommendations for snags, cavity trees, and downed woody debris (Section 7).</li><li>✓ State and local regulatory standards also apply.</li></ul> |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

<sup>1</sup> Stream order is often used as a guide to establishing the width of riparian management zones.

- First-order perennial streams are shown as solid blue lines on a U.S.G.S. topographic map.
- Second-order streams are formed by the confluence of two first-order streams.
- Third-order streams are formed by the confluence of two second-order streams.
- Fourth-order streams are formed by the confluence of two third-order streams.

Topographic maps may be inaccurate; use site visits to identify small perennial and intermittent streams.

<sup>2</sup> Increase management zone width up to 250 ft. with increase in slope and decrease in soil permeability.

<sup>3</sup> *Best Management Practices for Forestry: Protecting Maine's Water Quality*. Department of Conservation, Maine Forest Service, 22 SHS, Augusta, ME 1-800-367-0223

**References:** Carlson 1999, Pelletier 1999a



# Vernal Pools

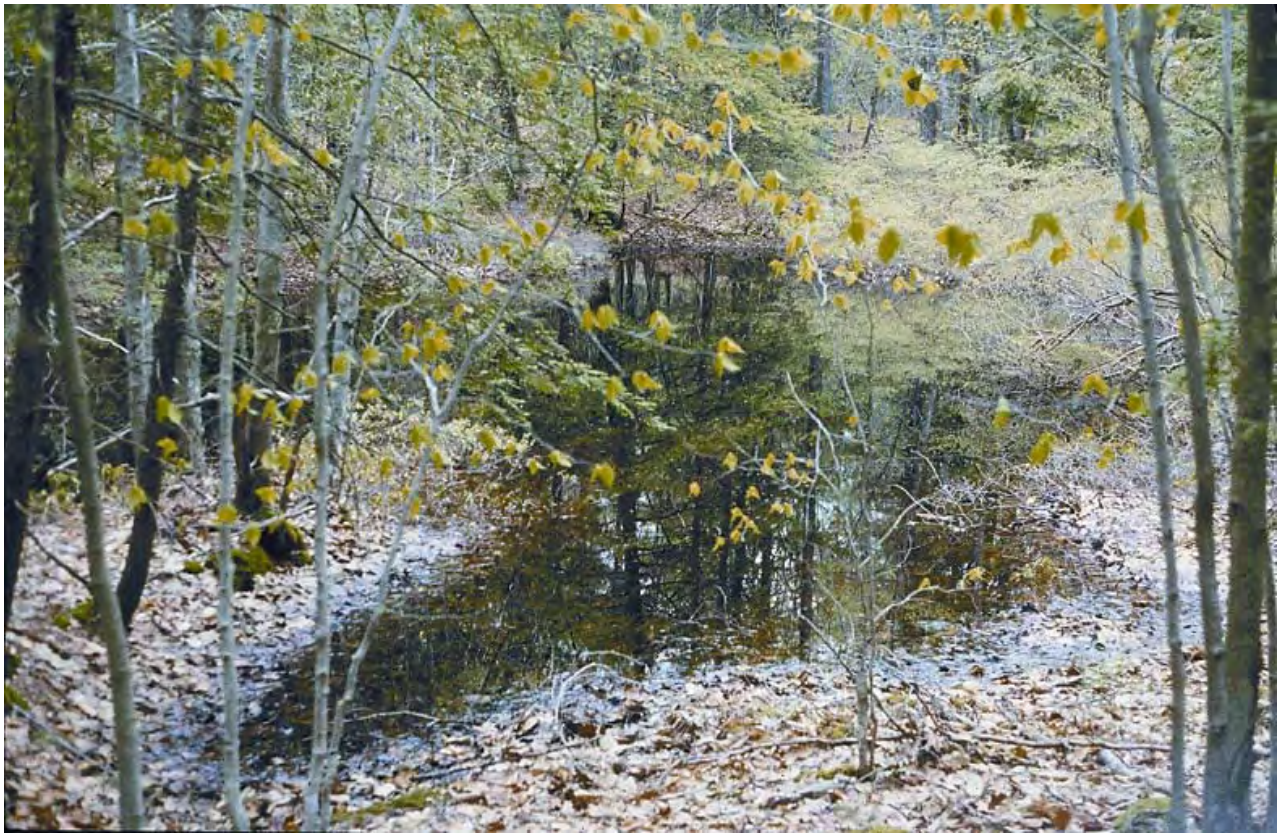


Photo: Jamie Haskins

## Identification

Vernal pools are small (typically less than one acre) seasonal wetlands that lack perennial inlet or outlet streams and have no permanent fish populations. Most vernal pools hold at least 12 in. of water at spring maximum and contain water for 2.5 months or more in the spring and summer. Typically they dry out in late summer and begin to fill again with fall rains. The presence of a vernal pool is confirmed by spring surveys (April or May depending on weather conditions and region) for adults or egg masses of one of the four vernal pool indicator species (see Wildlife, below). In late summer or fall look for depressions with water-blackened leaves.

## Ecology

Vernal pool amphibians lay their eggs in early spring. For the gilled tadpoles and salamander larvae it is a race against time to develop legs and lungs and migrate to the nearby forest before the pool dries. Vernal pools are largely found in forested habitats where vernal pool amphibians spend most of their lives. Most vernal pool salamanders live in the forest soil within a few hundred feet of the pool.

| Focus Species                   |
|---------------------------------|
| Spotted salamander<br>Wood frog |

## Wildlife

**Indicator Species:** Wood frog, spotted salamander, blue-spotted salamander, and four-toed salamander. Fairy shrimp occur less frequently. Populations of these animals are dependent on vernal pools that are absent of predatory fish. Green frogs, spring peepers, caddis flies and rare reptiles (see below) may also be present. While most amphibians return to the pools where they were born, enough migrate to other pools to prevent inbreeding and to help sustain the population across the landscape. Adults, larvae, and tadpoles of vernal pool amphibians are an important prey base for forest animals.

# Vernal Pools

## Rare Species

- Blanding's turtle (Maine threatened) and spotted turtle (Maine endangered) may be found in vernal pools in York and Cumberland counties
- Four-toed salamander, ribbon snake, and wood turtle (all Maine special concern) may also be found in vernal pools statewide
- Several rare plants are associated with vernal pools in southern Maine



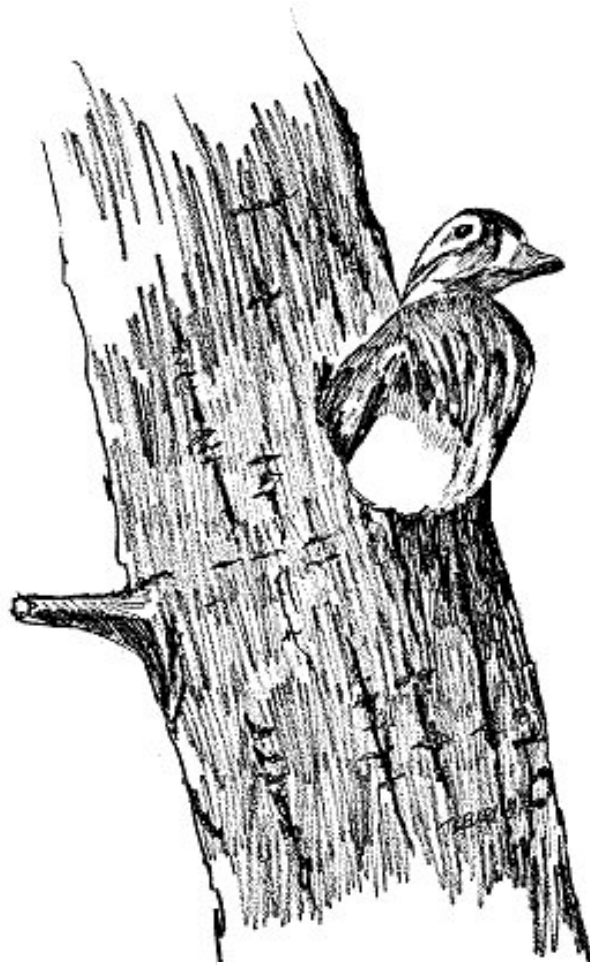
Apply the following guidelines at minimum when two or more indicator species or more than 20 egg masses have been observed.

| Focus Species Management <sup>1</sup>                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vernal Pool Depression                                                                                                                                                                                                                    | Vernal Pool Protection Zone<br>0-100 ft.                                                                                                                                                                                                                                                                                                                                                  | Amphibian Life Zone<br>100-400 ft.                                                                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li>✓ Identify and flag the pool boundary during the spring wet season or by using dry-season indicators.</li> <li>✓ Do not disturb the pool depression with equipment, slash, or sediment.</li> </ul> | <ul style="list-style-type: none"> <li>✓ Maintain an average 75% canopy cover of trees over 20-30 ft. tall to protect young amphibians leaving the pool.</li> <li>✓ Harvest in frozen or dry conditions to prevent rutting and protect habitat of soil-dwelling salamanders.</li> <li>✓ Maintain abundant coarse woody debris used as feeding habitat and cover by amphibians.</li> </ul> | <ul style="list-style-type: none"> <li>✓ Maintain a minimum of 50% canopy cover of trees over 20-30 ft. tall and keep openings below one acre.</li> <li>✓ Harvest in frozen or dry conditions to minimize soil disturbance.</li> <li>✓ Maintain abundant coarse woody debris.</li> </ul> |

<sup>1</sup> For more information on identification and management of vernal pools see: *Maine Citizens Guide to Locating and Describing Vernal Pools* and *Forestry Habitat Management Guidelines for Vernal Pool Wildlife in Maine*. Both are available from Maine Audubon, Conservation Department (207-781-2330).

**References:** Calhoun, A.J.K. 2003; Calhoun, A.J.K. and P. deMaynadier 2004





*Wood Duck (U.S. Fish and Wildlife Service)*

## 6. Focus Species Profiles and Management Recommendations

The following pages include range, habitat, and management information for each focus species. Following is a guide to interpreting and using the management profiles.

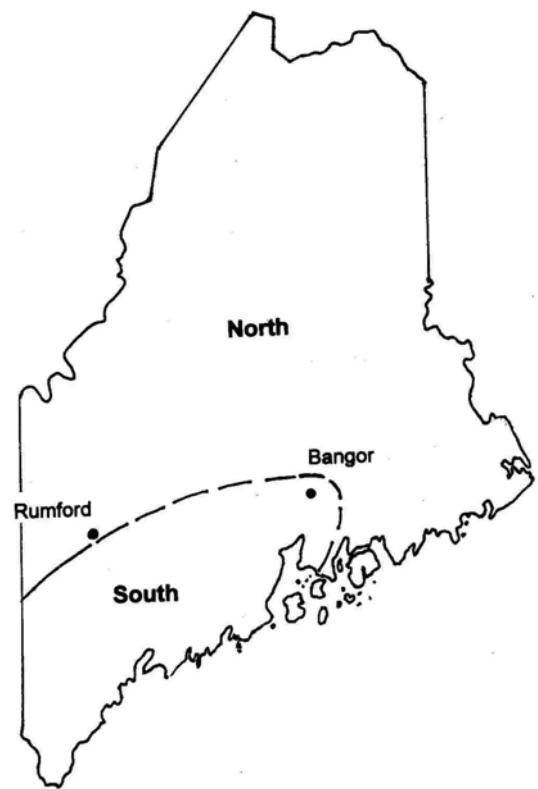
**Maine Focus Region:** Because species vary in their abundance across the state, some species are not focus species for the entire state. Figure 1 shows Maine's focus species habitat regions. The North Region largely corresponds with the area where extensive spruce-fir forests are found. The South Region is associated with the approximate northern and eastern limit of red oak as a significant forest component (Allen and Plantinga 1999) and by the southern limit of American marten.

**Home Range:** Home range is the area typically used by an animal over the course of a year. In cases where males and females have different home ranges, the larger value is given. Home ranges between individual animals often overlap. At the landscape or regional level a viable population may require the area equivalent to many home ranges.

**Territory:** Territory refers to the area that a pair of songbirds actively defends during the nesting season. While the area defended by a single pair of birds may be very small, the species may most likely to be found in large forest patches. For example, the wood thrush has a territory ranging from 0.2-7 acres, but data from the northern forest region show that it is most abundant in forest patches that exceed 200 acres.

**Management:** This section includes specific management recommendations for each focus species. These recommendations should be used in conjunction with the management recommendations in the habitat management guides and the guides to stand and landscape-scale management (Sections 7 and 8).

**Figure 1. Focus Species Regions**





**Habitat Use:** The habitat-use chart<sup>3</sup> identifies the specific ecosystems and development stages that are focus habitats for the species as well as and other habitats that it uses.

**Focus Habitat:** For most species listed, a focus habitat is one that provides the best overall habitat conditions for the species. For a few, the focus habitat is one that is used for only part of the year but is essential for the species' survival. Examples of the latter include wintering areas for deer in northern Maine and vernal pools that are used seasonally by wood frogs and spotted salamanders.

- ✓ Where a species focus habitat includes two or more development stages, attempt to provide at least half of the area in the older development stages.
- ✓ Small-diameter intermediate stands may provide early successional habitat, while larger-diameter intermediate stands are likely to provide habitat for many mature-forest species.
- ✓ Although all mature forest species will do equally well in late-successional habitat, late successional is only listed as a focus habitat when it is a required habitat for a species.

**Other Habitat:** "Other habitat" is habitat commonly used by a species, but it is used less frequently or is less critical (e.g. non wintering habitat for deer) than a focus habitat. The "other habitat" needs of a given species are taken care of by other focus species. For example, spruce-fir is listed as "other habitat" for pileated woodpecker. Management for black-backed woodpecker and American marten, both spruce-fir focus species, will also provide habitat for the pileated woodpecker in that forest type.

**Habitat Use Modifiers:** Some species are most likely to be found in certain forest types only when certain habitat conditions are found.

| Habitat Use Modifiers |                                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------------|
| <b>Mx</b>             | A coniferous component in hardwood forests or deciduous component in softwood forests is important |
| <b>U</b>              | Identifies when a species requires understory saplings or shrubs                                   |
| <b>C</b>              | Requires or is strongly associated with snags or cavity trees                                      |

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<sup>3</sup> The format of the habitat use chart was adapted from charts that first appeared in the U.S. Forest Service publication *New England Wildlife: Habitat, Natural History, and Distribution* (DeGraaf and Rudis, 1986). Habitat uses in this guide represent the author's synthesis of current literature and input from the advisory committee.

# Snowshoe Hare

**Distribution:** Alaska to Newfoundland, south to the Sierra Nevada, Rockies, New England, and the Appalachians

**Maine Focus Region:** Statewide

**Home Range:** About 10 acres per individual, with populations in excess of one per acre at population peaks

**Food:** Herbaceous vegetation in summer; twigs, buds, and bark of hardwoods, shrubs, and northern white cedar in winter

**Special Habitat Needs:** Dense conifer saplings for winter cover and deciduous browse. Prefers stem densities of 5,000-13,000 per acre and height greater than snow depth but within reach. Canopy is typically 6-12 ft. tall and 6-25 years old.



## Management:

- ✓ In spruce-fir, create patches of regeneration less than 20 acres in size using large-group selection, shelterwood, or clearcutting if shelterwood is not possible.
- ✓ Selection management that promotes a conifer understory will produce hare at lower densities but over a greater number of acres than will even-aged management.
- ✓ In northern and eastern Maine, balance the habitat needs of hare with the mature conifer cover needs of marten and wintering deer.
- ✓ Maintain travel corridors for predators (e.g. lynx will not cross large clearcuts).

**Comments:** Snowshoe hare is a critical prey base for many species, including bobcat, lynx, coyote, and American marten. In northwest Maine the threatened Canada lynx is closely associated with high concentrations of hare in regenerating even-aged softwoods. Check with MDIFW biologists for the latest recommendations in areas where lynx may be present.

## Habitat Use

| Forest Ecosystems |    |    |    |                    |    |    |    |    |          |    |    |    |    |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                         |             |  |
|-------------------|----|----|----|--------------------|----|----|----|----|----------|----|----|----|----|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|-------------------------|-------------|--|
| Aspen-Birch       |    |    |    | Northern Hardwoods |    |    |    |    | Oak-Pine |    |    |    |    | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |  |
| R                 | S  | I  | M  | R                  | S  | I  | M  | L  | R        | S  | I  | M  | L  | I       | M | L | R          | S | I | M | L                      | I              | M | L |                         |             |  |
| Mx                | Mx | Mx | Mx | Mx                 | Mx | Mx | Mx | Mx | Mx       | Mx | Mx | Mx | Mx | U       | U | U |            |   |   | U | U                      | U              | U | U | U                       | Mx, U       |  |

R Regeneration and seedlings    Mx Mixed conifer-deciduous  
S Saplings and small poles    U Understory present  
I Intermediate-aged forest    C Cavity tree or snag  
M Mature forest  
L Late-successional forest

Focus habitat  
Other habitat  
Little/no use

**References:** DeGraaf and Yamasaki 2001, Jakubas and Cross 2001, Koeller and Bridell 1990, Krohn and Allen 1988, Williamson undated



**Distribution:** Alaska to northern Quebec, south to the Florida panhandle, Texas, and northern California

**Maine Focus Region:** Statewide

**Home Range:** Limited to areas flooded by dam and adjacent forest; up to 0.6 miles along streams. Young disperse from natal colony after 2 years.

**Food:** Bark and twigs of poplars and alder are preferred, plus other deciduous trees and shrubs. In summer beaver also feed on grasses, sedges, and aquatic plants.

**Special Habitat Needs:** Slow-moving rivers and streams or lakes and ponds

## Management

- ✓ Refer to riparian and wetland forest management guidelines (Section 5).
- ✓ Landowners who want to attract beaver should manage for deciduous species, especially poplars, along slow-moving streams.
- ✓ Install water-control devices to limit flooding of valuable timber and damage to roads. Contact the Maine Department of Inland Fisheries and Wildlife (MDIFW) for technical assistance.



**Comments:** By flooding lowland areas, beavers create important habitat for a wide range of species, including fish, amphibians, waterfowl, swallows, woodpeckers, moose, and bats. However, beaver can damage roads and timber. Because beaver benefit so many other species, using beaver excluders in culverts and perforated pipes and other devices to control water levels in dams, or sustainable levels of trapping, is preferable to eliminating beavers altogether.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|-------------------------|-------------|
| Aspen Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   |                        |                         |             |

R Regeneration and seedlings    Mx Mixed conifer-deciduous  
 S Saplings and small poles    U Understory present  
 I Intermediate-aged forest    C Cavity tree or snag  
 M Mature forest  
 L Late-successional forest

 Focus habitat  
 Other habitat  
 Little/no use

**References:** Burt 1976, Foss 1999a, DeGraaf and Yamasaki 2001

# American Marten

**Distribution:** Alaska to Newfoundland, south to Nevada, New Mexico, northern Minnesota, northern New York, and northern Maine

**Maine Focus Region:** North

**Home Range:** Average 1 sq. mi. for females, 2 sq. mi. for males (640-1,280 acres)

**Food:** Primarily small mammals including voles, mice, red squirrels; also grouse, hare, bird eggs, fruits, berries, and nuts



**Special Habitat Needs:** Extensive mature hardwood, mixed-wood, or conifer forests with abundant snags and downed trees and other structural features

## Management:

- ✓ Maintain an average of 7 marten habitat units (no less than 2) per township that are:
  - >1,250 acres, with
  - 75% of stands >40 ft. tall with basal area >80 sq. ft./acre, and
  - include at least one large, intact patch of 700-1,000 acres that meets the height and density requirements above.
- ✓ Maintain dead trees, logs, root mounds, and other structural features as denning sites and cover for small mammals that are the marten's staple diet. See snag and cavity tree guidelines (Section 7).
- ✓ Use even-aged or uneven-aged management, as long as basal area, height, and snag/deadwood goals are met. Regeneration using a shelterwood-with-reserves system in conifer and mixed stands will promote softwood regeneration and prey, especially snowshoe hare, while maintaining canopy cover.
- ✓ Restrict access during trapping season.

**Comments:** Commonly called the pine marten in Maine. Extensive research at the University of Maine suggests that management for marten will provide habitat used by most northern forest species, except those that require very young or late-successional forest conditions. Marten are easily trapped, so where road densities are high, access should be restricted during trapping season to enhance survival

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                          |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|--------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/ Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |                          |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |                        |                |   |   |                          |             |

RRegeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

MxMixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

**References:** Boone and Krohn 1998, Burt 1976, Chapin et al. 1998, DeGraaf and Yamasaki 2001, Fuller and Harrison 2000, Harrison 2004, Payer and Harrison 2003, Payer and Harrison 2000a, Payer and Harrison 2000b



**Distribution:** Southeast Alaska to Newfoundland, south to central Connecticut, Minnesota, and the mountains of Colorado and California; expanding to Pennsylvania and West Virginia where reintroduced

**Maine Focus Region:** South

**Home Range:** 6-20 sq. mi. (4,000-13,000 acres)



**Food:** Snowshoe hare, cottontail rabbit, porcupine, squirrels and other small mammals, birds, berries, and other fruits

**Special Habitat Needs:** Generally associated with mature conifer and mixed forests, but found in a variety of forest types and age classes. Dens in hollow trees, logs, or under boulders.

## Management:

- ✓ Maintain landscapes with extensive forests. In developing areas maintain a network of woodlots and interconnected travel corridors. See landscape recommendations (Section 8).
- ✓ Maintain dead trees, logs, and other structural features as denning sites and cover for small mammals that are the fisher's staple diet.
- ✓ Create small openings to enhance vegetation diversity and prey abundance.
- ✓ Maintain or enhance softwood inclusions, including softwood understory cover.
- ✓ See management guide for snags, cavity trees, and downed woody material (Section 7).

**Comments:** Landscapes that support fisher are used by a wide variety of forest wildlife. Family forests are important to the survival of this large member of the weasel family in southwestern and central Maine. Mature conifers are important in northern Maine where deep snow limits fisher populations. The fisher has been expanding southward into eastern Massachusetts and Connecticut, suggesting that it can tolerate human settlement if interconnected forests are available.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   | Special-value Habitats |   |                |   |   |                          |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|------------------------|---|----------------|---|---|--------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |                        |   | N. White Cedar |   |   | Riparian/ Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M                      | L | I              | M | L |                          |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |                        |   |                |   |   |                          |             |

RRegeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

MxMixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

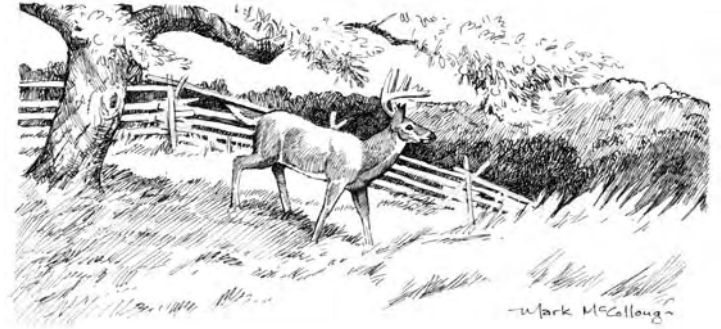
Little/no use

**References:** Burt 1976, DeGraaf and Yamasaki 2001, Snyder undated, Krohn 2004

# White-tailed Deer

**Distribution:** Southern Canada and the United States except west of the Cascades, California, and Utah

**Maine Focus Region:** North, due to its dependence on large areas of relatively mature to mature conifer cover for winter habitat. Common, but not a focus species in the South Region.



**Home Range:** Typically 150-1,300 acres for non-migratory deer (e.g. southern Maine); 1,300-7,500 acres in northern regions with deep snow. Some deer from Canada travel up to 100 miles to fall and winter range in northern Maine.

**Food:** Forbs, grasses, sedges, and ferns in spring and summer; acorns, beechnuts, mushrooms, and leaves in fall; twigs and buds in winter

**Special Habitat Needs:** Mature softwood stands for winter cover interspersed with browse from seedlings and young saplings

## Management

- ✓ Harvesting in zoned Deer Wintering Areas (DWA) in the unorganized townships is regulated by the Land Use Regulatory commission, but experience has shown that only managing for winter range in zoned DWA is inadequate. Landowners in this region are encouraged to develop a cooperative management agreement with the Department of Inland Fisheries and Wildlife.
- ✓ Maintain at least 50% of a DWA in closed-canopy softwood cover where winter snows limit movement while encouraging browse in small, dispersed harvest units.
- ✓ Consult with the MDIFW regional biologist about the location of DWA and specific management recommendations.

**Comments:** Deer are closely associated with Maine's hunting tradition and are popular with non-hunters as well. Lack of adequate winter range is limiting populations of this culturally important animal in northern and eastern Maine, and management for other northern species may not provide adequate winter habitat. MDIFW's long-term objectives for northern Maine are to increase deer wintering habitat from the current 1.5% of the landscape to 8-10% over the next 30 years.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |                        |                |   |   |                         |             |

R Regeneration and seedlings    Mx Mixed conifer-deciduous  
S Saplings and small poles    U Understory present  
I Intermediate-aged forest    C Cavity tree or snag  
M Mature forest  
L Late-successional forest

Focus habitat  
Other habitat  
Little/no use

**References:** DeGraaf and Yamasaki 2001, Foss 1999b, Hobson et al. 1993

## Focus Species Forestry



# Northern Goshawk

**Distribution:** Alaska to Newfoundland, south in the Rockies to New Mexico, northern Minnesota, New England, New York, and northern Pennsylvania

**Maine Focus Region:** Statewide

**Home Range:** 1 sq. mi.

**Food:** Hunts below the forest canopy and in openings for small and medium-sized birds and mammals including crows, ruffed grouse, red squirrels, and snowshoe hare; often takes birds on the wing

**Special Habitat Needs:** Extensive intermediate to mature forests that provide remote, infrequently disturbed nest sites.

## Management:

- ✓ Avoid harvesting within ¼ mile and recreation use within sight of nest during the breeding season (early March to mid August).
- ✓ Maintain an uncut buffer of 66 ft.-150 ft. around active and alternate nests.
- ✓ Use selection management to maintain 65-85% canopy closure beyond the uncut buffer up to 450 ft.
- ✓ Buffer width recommendations vary by source. Increase buffer width with increasing timber volume removals.
- ✓ Confine harvesting to one year.
- ✓ Manage for a landscape dominated by relatively-mature and mature forests with small openings.

**Comments:** Maine's largest accipiter, the goshawk is bigger than a crow and has a long rudder-like tail and short wings that allows it to pursue woodland prey beneath the forest canopy. Look for nests in three-pronged forks of mature hardwoods or the whorled branches of white pine; goshawks aggressively defend the nest site during breeding season. Because the goshawk requires extensive interior-forest habitat, managing for it will provide habitat for a wide range of mature forest species. Do not publicize the location of nest sites. Goshawks are prized by falconers, and nest sites have been subject to illegal poaching of chicks.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |  |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|--|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        |  | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |  |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   |                        |  |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use



**References:** Boone and Krohn 1998, DeGraaf and Yamasaki, 2001, Foss 1999c, Sibley 2000, Terres 1991

# Ruffed Grouse

**Distribution:** Year-round resident from Alaska to Newfoundland, south to the northern Rockies, lakes states, northeast U.S. and Appalachia

**Maine Focus Region:** Statewide

**Home Range:** 6-10 acres

**Food:** Young feed extensively on insects with increasing amounts of seeds and fruit with maturity; buds of aspen, birch, and other species critical in winter

**Special Habitat Needs:** 3 age classes of hardwood or mixed-wood forest: 1-15-year-old stands that provide cover and food for brood rearing, dense (2,000-8,000 stems/acre) 6-25-year-old stands for nesting and fall feeding, and older stands (>25 years) for winter feeding and roosting



## Management:

- ✓ Maintain at least three age classes in a 10-50-acre area using group selection, small clearcuts or shelterwood cuts 1-10 acres in size. Keep patches of different ages in close proximity to one another. Grouse management blocks can be maintained on a 40-60 year cutting cycle, harvesting 25% of the area every 10-15 years. Use the shorter cycle for aspen and the longer cycle for other hardwood species.
- ✓ Extend the rotation when sawlog production is a goal, but continue to create new habitat patches every 10-15 years.
- ✓ Leave large logs during harvest that can be used as drumming sites when the new stand develops.
- ✓ Leave tops well distributed on the site to maintain soil fertility and limit deer browsing.
- ✓ Maintain apples, raspberries, and other fruit-bearing shrubs.
- ✓ Maintain semi-permanent herbaceous openings of 0.5-0.75 acre on every 10 acres for feeding and brood rearing. Old apple orchards, log landings, roadsides, and old fields are good sites.

**Comments:** Managing for ruffed grouse will also provide habitat for rabbits, hare, and other early successional forest species. Grouse management can be combined with woodcock management if permanent herbaceous openings of at least 1 acre (preferably >3 acres) are maintained for use as singing and summer roosting grounds.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |  |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|--|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        |  | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |  |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   |                        |  |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** DeGraaf and Yamasaki 2001, Hobson et al. 1993, Williamson (undated), Krohn and Allen 1988, Sepik et al. 1981



**Distribution:** Alberta to Newfoundland, south to Florida and east Texas; also British Columbia, south to northwestern California

**Maine Focus Region:** Statewide

**Home Range:** 200-900 acres

**Food:** Primarily mice; also other small mammals, birds, snakes, salamanders, frogs, and crayfish. Hunts from low branches, often at edge of forest openings.

**Special Habitat Needs:** Extensive mature deciduous or mixed forest with large (>20 in.) cavity trees

## Management:

- ✓ Maintain a landscape with extensive mature forest; uneven-aged management is probably best unless long even-aged rotations are used to create large areas of mature forest.
- ✓ Manage for large snags and cavity trees.
- ✓ Small openings may attract foraging owls.



**Comments:** The barred owl's "Who cooks for you, who cooks for you-all?" may be heard throughout the year but is most common during the late winter/early spring breeding season. Managing for the large cavity trees and forest-dominated landscapes used by barred owls will help ensure adequate habitat for other species that prefer mature deciduous forests.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |                         |             |
|                   |   |   |   |                    |   | C | C | C |          |   | C | C | C |         | C | C |            |   | C | C | C | C              | C | C                      | C                       |             |

R Regeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

Mx Mixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Sibley 2000, Terres 1991

# Black-backed Woodpecker

**Distribution:** Alaska to Newfoundland, south to the Sierras and Rockies, northern and eastern Maine, northern New Hampshire and Vermont; locally associated with spruce-fir in the Adirondacks

**Maine Focus Region:** North

**Home Range:** Approximately 75 acres

**Food:** Bark beetles and other insects in decaying conifers

**Special Habitat Needs:** Dead spruce, fir, pine or tamarack with loose bark for feeding; live or dead spruce, fir, or white pine trees >10 in. dbh for excavating nest cavities.



## Management

- ✓ Maintain extensive mature conifer forest with a steady supply of snags and potential cavity trees (see Section 7).
- ✓ Use shelterwood or uneven-aged management.
- ✓ A patchy distribution of stands rather than extensive, uniform stands probably best mimics the natural disturbances that create feeding habitat for this species.
- ✓ See recommendations for marten and white-tailed deer in this section.

**Comments:** Maintaining the dead and dying trees used by black-backed woodpeckers will benefit a wide range of species that use cavities and dead-wood spruce-fir forests. Freshly exposed wood where large patches of bark have been flaked away are a sign of recent black-backed woodpecker activity. This uncommon boreal forest bird, which is often associated with conifers killed by beaver flooding, spruce budworm, and bark beetles, is potentially threatened by efficient, even-aged spruce-fir management. In eastern Maine it has been found in intermediate to mature white pine stands where it nests and feeds in live trees. Like most other woodpeckers in our region it usually excavates a new cavity every year, so a continuous supply of potential spruce or fir cavity trees is important.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                | Special-value Habitats |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|------------------------|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |                        |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M                      | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   | C | C | C | C              | C                      | C | C                       | C           |

R Regeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

Mx Mixed conifer-deciduous

U Understory present

C Cavity trees, snags, decaying trees

Focus habitat

Other habitat

Little/no use

**References:** Bates 2004, Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Sibley 2000, Terres 1991



# Pileated Woodpecker

**Distribution:** British Columbia to Nova Scotia, south to Florida, east Texas, and northern California

**Maine Focus Region:** Statewide

**Home Range:** 100-200 acres

**Food:** Insects in decaying wood, particularly carpenter ant colonies in decaying trees

**Special Habitat Needs:** Large (>20 in. diameter) cavity trees for nesting; dead or decaying deciduous trees or conifers for feeding

## Management

- ✓ Maintain mature forest stands.
- ✓ Maintain an abundance of large snags and live trees with decaying wood in managed stands (see Section 7).



**Comments:** Pileated woodpeckers frequently excavate large rectangular feeding cavities (2-3 in. wide by 4-6 in. high) in live trees, often low on the bole where ants are present in decayed wood. This large, crow-sized woodpecker with black body, white underwings, and loud “*kuk kuk kuk kuk*” call is readily identified by sight, sound, or sign of feeding activities. Because the pileated, like most other woodpeckers, usually excavates a new nest cavity every year, an abundance of potential cavity trees is important. Bats, marten, fisher, barred owls, flying squirrels, raccoons, and other animals will benefit from cavities excavated by pileated woodpeckers. Wood ducks, goldeneyes, hooded mergansers, and common mergansers nest in large cavities excavated by pileated woodpeckers near streams and ponds.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |                         |             |
|                   |   |   | C |                    |   | C | C | C |          |   | C | C | C | C       | C | C |            |   | C | C | C | C              | C | C                      | C                       | C           |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity trees, snags, or decaying trees

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Sibley 2000, Terres 1991

# Wood Thrush

**Distribution:** Breeding-season resident of eastern deciduous woodlands from southern Quebec to the Gulf Coast

**Maine Focus Region:** South

**Territory:** Up to 7 acres

**Food:** Predominantly insects in summer, plus berries and other small fruits in fall, winter, and spring

**Special Habitat Needs:** Cool, moist, mature closed-canopy deciduous and mixed forests with well developed shrub-sapling layer. Found at greatest densities in forest patches greater than 200 acres, with a sharp decline in abundance in patches less than 100 acres in size.



## Management:

- ✓ Maintain mature northern hardwood and oak-pine forest and encourage understory development with group or single-tree selection.
- ✓ On large ownerships shelterwood management may be appropriate if mature forest goals are met at the landscape level. See landscape management guide (Section 8).

**Comments:** This robin-sized thrush with spotted breast and rusty head is readily identified by its distinct flute-like “ee-o-lay-ee” call on spring and summer evenings or in the early morning. It is frequently seen in low shrubs or scratching in the leaf litter for insects and other food. Numbers observed during the breeding season in Maine are declining. Nesting success increases with the percent of forest in the landscape. The wood thrush winters in Mexico and Central America. Many mammals and plants characteristic of extensive mature forest will benefit from wood thrush management. Because the wood thrush feeds mostly on or near the ground, it is vulnerable to predation by domestic cats. The hermit thrush, which is characteristic of mixed hardwood-conifer forest throughout Maine, has similar habitat requirements and is also negatively impacted by habitat loss and fragmentation.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   | Special-value Habitats |   |                |   |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|------------------------|---|----------------|---|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |                        |   | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M                      | L | I              | M | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |                        |   |                |   |   |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, Rosenberg et al. 2003, Sauer et al. 2003, Sibley 2000, Terres 1991



# Chestnut-sided Warbler

**Distribution:** Alberta to New Brunswick, south along the Appalachians to Georgia

**Maine Focus Region:** Statewide.

**Territory:** 1-3 acres

**Food:** Insectivorous; prefers caterpillars and fly larvae

**Special Habitat Needs:** Dense early successional hardwoods up to 10 ft. tall with less than 35% overstory canopy closure. Prefers forest patches in excess of 250 acres.

## Management:

- ✓ Use group selection to create patches averaging 1 acre in size, or shelterwood or clearcut harvests, to create nesting habitat for chestnut-sided warblers.
- ✓ Balance early successional habitat with requirements of mature-forest species at the property or landscape level. See landscape management guidelines (Section 8).



**Comments:** Males defend their territory by singing from tall saplings and residual overstory trees while the female incubates 4-5 eggs in the brush below. John James Audubon considered this one of the rarest birds in the east during the early 1800s, but timber harvesting and regrowth of farmland have made it a relatively common species. Management for the chestnut-sided warbler will benefit other species that use early successional hardwoods, such as moose, woodcock, white-tailed deer, nighthawk, willow flycatcher, eastern bluebird, Tennessee warbler, and mourning warbler. The chestnut-sided warbler's loud "*pleased pleased pleased to meet-ya*" may be confused with the magnolia warbler during the spring and early summer breeding season when the two species may be found together in mixed hardwood-conifer stands.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |                        |                |   |   |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, King 2003, Sauer et al. 2003, Sibley 2000, Terres 1991

# Magnolia Warbler

**Distribution:** British Columbia to Newfoundland, south to northern Minnesota, northern New England, and locally in suitable habitat down the southern Appalachian ridge

**Maine Focus Region:** Statewide

**Territory:** 2-3 acres

**Food:** Gleans bark of conifers for insect larvae and adults

**Special Habitat Needs:** Spruce-fir or less frequently hemlock-hardwood forests with well-developed understory and less than 70% canopy cover; most abundant in early successional stands

## Management:

- ✓ Adaptable to a range of management techniques that create an open or partial canopy (less than 50-70% canopy cover), including selection, shelterwood, or clearcutting (see spruce-fir or northern hardwood management guide for mixed hemlock-hardwoods).

**Comments:** Other species that may be found in young spruce-fir along with the magnolia warbler include snowshoe hare, Canada lynx, moose (when hardwood browse is present), yellow-bellied flycatcher, and purple finch. Both the male and female have a distinctive yellow rump, throat, and streaked breast. Magnolia warblers are often seen feeding in understory conifers. The magnolia warbler's song "weeta-weeta-witchu" is sometimes confused with that of the chestnut-sided warbler during the spring and summer breeding seasons. Winters in Central America and the West Indies.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |    |    |    |    |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|----|----|----|----|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |    |    |    |    | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S  | I  | M  | L  | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |                         |             |
|                   |   |   |   | Mx                 | Mx | Mx | Mx | Mx |          |   |   |   |   | U       | U | U |            |   |   | U | U | U              |   |                        |                         |             |

R Regeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

Mx Mixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, Sauer et al. 2003, Sibley 2000, Terres 1991





# Black-throated Blue Warbler

**Distribution:** Breeding-season resident from southern Ontario to Nova Scotia to the southern Appalachians; absent from the southern Maine coast and southeastern New England

**Maine Focus Region:** Statewide

**Territory:** 2-5 acres

**Food:** Caterpillars and other insects

**Special Habitat Needs:** Primarily associated with extensive, mature northern hardwood forests with abundant shrubs or saplings



## Management:

- ✓ Uneven-aged management that maintains a high canopy and abundant regeneration is ideal; shelterwood stands with a residual canopy or pole-sized or mature even-aged stands will also provide habitat.
- ✓ Maintain large, contiguous blocks of forest.

**Comments:** Listen for the loud, ascending and buzzy “*beer, beer, beer bee?*” of the black-throated blue warbler in northern hardwoods or mixed stands where maple or beech are present. The species winters along the Gulf Coast and on islands in the Caribbean. Other mature northern hardwood species associated with black-throated blue warbler habitat include downy and hairy woodpeckers, white-breasted nuthatch, red-eyed vireo, wood thrush, black and white warbler, ovenbird, scarlet tanager, northern flying squirrel, woodland jumping mouse, fisher, and marten.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |    |    |    |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|----|----|----|----------------|---|------------------------|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |    |    |    | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I  | M  | L  | I              | M | L                      |                         |             |
|                   |   | U | U |                    |   | U | U |   |          |   |   |   |   |         |   |   |            |   | Mx | Mx | Mx |                |   |                        |                         |             |

R Regeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

Mx Mixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

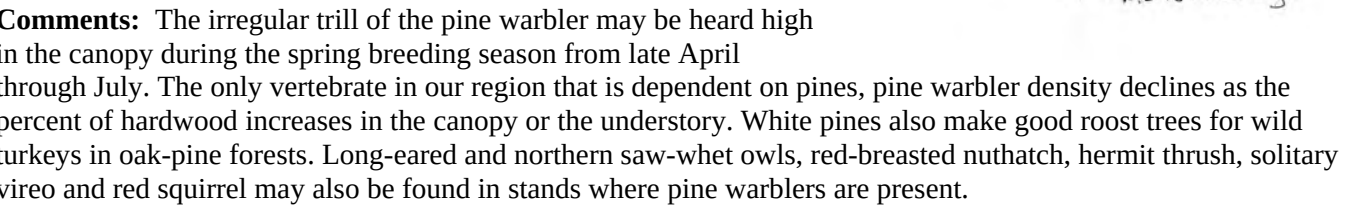
**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, Sauer et al. 2003, Sibley 2000, Terres 1991

**Maine Focus Region:** Statewide

**Food:** Adult and insect larvae, spiders

**Management:**

- ✓ Manage for intermediate or mature white pine or pitch pine in pure or mixed stands as a component of the forest.



| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |    |    |    |    |         |   |   |            |    |    | Special-value Habitats |    |                |   |   |                          |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|----|----|----|----|---------|---|---|------------|----|----|------------------------|----|----------------|---|---|--------------------------|-------------|
| Aspen -Birch      |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |    |    |    |    | Hemlock |   |   | Spruce-Fir |    |    |                        |    | N. White Cedar |   |   | Riparian/ Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S  | I  | M  | L  | I       | M | L | R          | S  | I  | M                      | L  | I              | M | L | M,L                      |             |
|                   |   |   |   |                    |   |   |   |   |          | WP | WP | WP | WP |         |   |   |            | WP | WP | WP                     | WP |                |   |   | WP                       |             |

## Focus Species Forestry



# Northern Waterthrush

**Distribution:** Alaska to Newfoundland, south to Washington, Ohio, and Pennsylvania

**Maine Focus Region:** Statewide

**Territory:** 1-4 acres

**Food:** Aquatic insects, occasionally mollusks and crustaceans

**Special Habitat Needs:** Forested wetlands with pools of standing water or pond shores with dense brush. Nests in upturned root masses.

## Management

- ✓ Maintain forest and shrub-sapling cover in wetland areas.
- ✓ See riparian and wetland forest recommendations (Section 5).

**Comments:** More often heard than seen, the northern waterthrush announces its presence with a very loud, clear, descending “*here, here, here here here.*” One study in Maine found that the northern waterthrush was intolerant of timber harvesting. The species winters in the West Indies and northern South America. Riparian and wetland management zones inhabited by northern waterthrush protect water quality and aquatic habitat and provide for a wide range of other species including amphibians, some reptiles, mink, and many plants.



## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   |                        |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, Sauer et al. 2003, Sibley 2000, Terres 1991

# Eastern Towhee

**Distribution:** Breeding-season resident from Minnesota and southern Quebec to southern Maine, south to the Gulf of Mexico

**Maine Focus Region:** At its northern range limit in Maine, this species is a priority species only in the South

**Territory:** 1-6 acres

**Food:** Scratches in leaf litter for seeds, insects and snails

**Special Habitat Needs:** Prefers dry, early successional or regenerating forests with a dense, brushy understory

## Management:

- ✓ Adaptable to a range of management techniques that result in dense regeneration, including heavy selection, shelterwood, or clearcut harvests.

**Comments:** The eastern towhee is declining due to loss of the brushy, early successional forest that they prefer. This large sparrow with rusty sides is often heard scratching in the dry leaves of pine-oak forests. In the spring and early summer the male announces his presence with a loud “*DRINK your teeeeeee.*” Its call is a loud “*che-WINK.*” Towhees winter from southern New England to the Gulf of Mexico. Other early successional species such as ruffed grouse, eastern and New England cottontail rabbits, and chestnut-sided warblers may be found in young stands inhabited by eastern towhees.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   | U | U | U |         |   |   |            |   |   |   |                        |                |   |   |                         |             |

R Regeneration and seedlings    Mx Mixed conifer-deciduous  
 S Saplings and small poles    U Understory present  
 I Intermediate-aged forest    C Cavity tree or snag  
 M Mature forest  
 L Late-successional forest

Focus habitat  
 Other habitat  
 Little/no use



**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, Sauer et al. 2003, Sibley 2000, Terres 1991



# Northern Redback Salamander

**Distribution:** Nova Scotia to eastern Minnesota, south to Kentucky and the Smoky Mountains

**Maine Focus Region:** Statewide

**Home Range/Movement:** Up to 260 sq. ft., individuals often re-captured under the same rock or log

**Food:** Carnivorous, feeds on insects and other invertebrates found in the leaf litter

**Special Habitat Needs:** Forests with well developed leaf litter layer and woody debris

## Management:

- ✓ Uneven-aged management or even-aged stands over 50-60 years old provide the best redback habitat.



**Comments:** Look for this small (2-4 in.) salamander under branches, logs, or brush piles. The redback phase has dark sides and a red-brown dorsal stripe, while the “leadback” color phase is typically dark gray or brown throughout. Studies in New Hampshire found that the total biomass of redback salamanders was about twice that of breeding birds and equal to that of mice and shrews. By preying on soil organisms, redbacks probably play an important role in regulating decomposition of organic matter and are an important food source for other animals.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |                        |                |   |   |                         |             |

R Regeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

Mx Mixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Witham 1999

# Northern Dusky Salamander

**Distribution:** Southern Quebec, south to Alabama; apparently absent northeast of Presque Isle, Maine

**Maine Focus Region:** Statewide

**Home Range:** Variable, 15-500 sq. ft.

**Food:** Feeds mainly at night on small aquatic or terrestrial insects, crustaceans and other invertebrates

**Special Habitat Needs:** Cool, clear seeps; intermittent streams or small perennial streams. Found under rocks or logs at water's edge or in the bed of nearly dry streams.

## Management:

- ✓ Use Maine Forest Service Best Management Practices to avoid stream sedimentation and maintain streamside vegetation for shade, cover, and habitat for adult forms of aquatic insects.
- ✓ See riparian and wetland forest recommendations (Section 5).

**Comments:** Dusky salamanders are found high in the watershed above the range of brook trout and other fish. They are about 2.4-4.3 in. long, gray or brown, and frequently mottled. Duskie are frequently found in the company of two-lined salamanders but, unlike the two-lined, are intolerant of warm water and sediment. In the western mountains region, northern spring salamanders may be encountered more frequently than duskies in headwater streams. Dusky salamanders winter 12-20 in. below ground near streams. Insects associated with these small streams are prey for birds, and the cool, clear water sustains streams lower in the watershed that are critical for trout and other fish.

## Habitat Use

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |                        |                |   |   |                         |             |

R Regeneration and seedlings    Mx Mixed conifer-deciduous  
 S Saplings and small poles    U Understory present  
 I Intermediate-aged forest    C Cavity tree or snag  
 M Mature forest  
 L Late-successional forest

Focus habitat  
 Other habitat  
 Little/no use



**References:** Barbour et al. 1969, DeGraaf and Yamasaki 2001, Maine Forest Service 1992, Markowski 1999

# Spotted Salamander

**Distribution:** Eastern U.S. except the southeast coastal plain, north to southern Ontario, Quebec, and Canada.

**Maine Focus Region:** Statewide

**Home Range/Movement:** Most spend adult life within 1,000 feet of breeding pools

**Food:** Feeds on earthworms, insects, spiders, and slugs and other invertebrates found in rotting wood and subterranean tunnels

**Special Habitat Needs:** Breeds in seasonal or semi-permanent, fishless pools (vernal pools)

## Management:

- ✓ In April or May survey for vernal pools, which usually can be identified by the presence of egg masses.
- ✓ Manage forest cover and protect soils around vernal pools as described in the vernal pools management guide (Section 5).

**Comments:** 6-8 in. long and dark brown to blue-black with bright yellow spots, the spotted salamander is easily identified. It is most often seen as it migrates to vernal pools during the spring breeding season from mid March to late April on warm, rainy nights. Oval, generally fist-sized or smaller masses of up to 200 eggs surrounded by a thick gelatinous envelope are attached to fallen branches. Egg masses may be milky white or clear, but often turn greenish with algae. Eggs hatch in 1-2 months. Transformation from aquatic larvae to terrestrial juveniles with lungs takes place 2.5-3 months later. Adults spend most of their life in the forest floor but often emerge on moist nights to search for prey. Habitat loss from development near pools is the greatest threat to spotted salamanders. Its close relative the blue-spotted salamander has similar habits.



## Habitat Use

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                | Special-value Habitats |   |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|------------------------|---|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |                        |   | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M                      | L |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |                        |   |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, Calhoun 2003, Calhoun and deMaynadier 2003, DeGraaf and Yamasaki 2001, Smith 1999



# Wood Frog

**Distribution:** Alaska to Quebec and the Maritimes, south to Tennessee

**Maine Focus Region:** Statewide

**Home Range/Movement:** Terrestrial except for the breeding season, wood frogs may wander up to a half mile from breeding pools

**Food:** Small invertebrates including insects, spiders, and slugs

**Special Habitat Needs:** Breeds in seasonal pools (vernal pools), small fishless ponds, or occasionally quiet stream backwaters in a forested setting



## Management

- ✓ In April or May survey for vernal pools, which usually can be identified by the presence of egg masses. At other times of year, evidence of seasonal (spring to early summer) standing water a foot or more deep is a good indicator.
- ✓ Manage forest cover and protect soils in the vicinity of vernal pools as described in the vernal pools management guide (Section 5).

**Comments:** Vernal pools can best be identified during the spring breeding season. The duck-like “quacking” of the wood frog, which can be heard in March or early April in southern Maine or late April in the north, is a good way to locate breeding pools. For about three weeks after the short breeding season the softball-sized, floating, jelly-like egg masses with over 1,000 eggs can be seen attached to branches or emergent vegetation. The nearly black tadpoles transform into terrestrial juveniles in June or July. Wood frog tadpoles and adults are important prey for many reptiles and birds.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                | Special-value Habitats |   |                         |             |   |   |  |  |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|------------------------|---|-------------------------|-------------|---|---|--|--|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |                        |   | Riparian/Wetland Forest | Vernal Pool |   |   |  |  |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | R       | S | I | M          | L | R | S | I | M              | L                      | R | S                       | I           | M | L |  |  |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |                        |   |                         |             |   |   |  |  |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, Calhoun 2003, Calhoun and deMaynadier 2003, DeGraaf and Yamasaki 2001, Knox 1999

# Wood Turtle

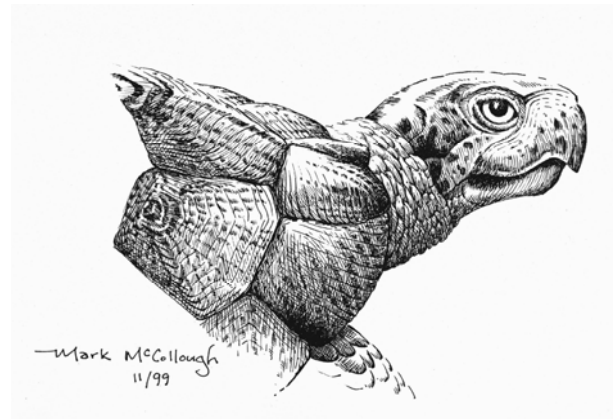
**Distribution:** Nova Scotia to eastern Minnesota, south to Pennsylvania

**Maine Focus Region:** Statewide

**Home Range/Movement:** Up to a quarter mile along rivers and streams; may be found in adjacent upland forests

**Food:** Omnivorous: berries, grass, insects, earthworms, tadpoles and carrion

**Special Habitat Needs:** Sandy-bottomed streams and rivers in a forested setting



## Management:

- ✓ Maintain large blocks of forested habitat near streams with potential wood turtle habitat.
- ✓ Follow recommendations for riparian and wetland forests (Section 5).

**Comments:** This small (5 ½- to 7 ½-inch) turtle with orange neck and legs may be found in upland forests near streams. The wood turtle is threatened by development and collecting throughout its range. In Maine it is listed as a species of special concern. Habitat fragmentation and road kill is a significant threat; populations within one mile of paved roads have been extirpated in Connecticut. Maintaining large unroaded blocks of forest around streams for wood turtles also benefits a wide range of forest species.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   | Special-value Habitats |                |   |   |  |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|------------------------|----------------|---|---|--|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |                        | N. White Cedar |   |   |  | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L                      | I              | M | L |  |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |                        |                |   |   |  |                         |             |

R Regeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

Mx Mixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Remley and Rhymer 1999

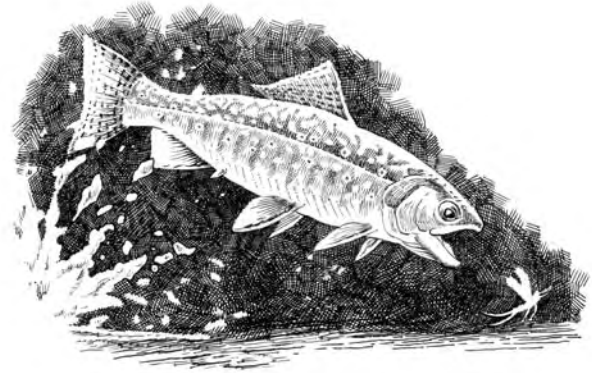
# Brook Trout

**Distribution:** Newfoundland to Manitoba, south along the Appalachians to Georgia

**Maine Focus Region:** Statewide

**Food:** Aquatic insect larvae and adults, especially when young, shifting to a higher percentage of fish with maturity

**Special Habitat Needs:** Cool, silt-free, and well-oxygenated water below 65° F



## Management

- ✓ Use Maine Forest Service Best Management Practices to avoid stream sedimentation and maintain streamside vegetation for shade, cover, and habitat for adult forms of aquatic insects.
- ✓ See riparian and wetland forest recommendations (Section 5).

**Comments:** This brightly colored native fish is an indicator of good water quality. Maine's wild brook trout fishery, the best in the United States, is threatened by development, illegal fish stocking, increased access to remote streams and ponds, and poor harvesting practices.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   | Special-value Habitats |                         |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|------------|---|---|---|---|----------------|---|------------------------|-------------------------|-------------|
| Aspen-Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |   |                        | Riparian/Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R          | S | I | M | L | I              | M | L                      |                         |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |            |   |   |   |   |                |   |                        |                         |             |

R Regeneration and seedlings  
S Saplings and small poles  
I Intermediate-aged forest  
M Mature forest  
L Late-successional forest

Mx Mixed conifer-deciduous  
U Understory present  
C Cavity tree or snag

Focus habitat  
Other habitat  
Little/no use

**References:** Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Maine Forest Service 1992, Witham 1999



# Late-Successional Forest Species

**Comments:** Late-successional forests provide habitat not found in younger forests. For example, research has found that certain tree lichens rarely occur in younger forests, and lichen diversity increases with forest age. Evidence suggests that other taxonomic groups—including invertebrates, fungi, mosses, and liverworts—have species characteristic of and probably dependent on late-successional or old-growth forest.

The conservation of late-successional forests is an area of emerging concern in Maine. Research has only begun to shed light on some of the unique values of these older forests. Remnants of late-successional forests are increasingly rare and are rapidly disappearing due to ongoing harvesting.

**Identification:** Late-successional forests are identified by their unique characteristics. These characteristics begin developing when stands reach approximately 100 years of age and continue to develop as stands reach old growth at 150-200 years old. Common characteristics of late-successional stands for most forest types and sites include:

- main crown canopy consisting of shade-tolerant or long-lived mid-tolerant species,
- relative stability of species composition,
- stable or declining live timber volume,
- accumulation of large snags and large downed woody debris, and
- live trees approaching the expected maximum diameter for the site.

Where the canopy is dominated by long-lived trees, indicators may include:

- presence of recognized late-successional species (such as certain mosses, lichens, or other epiphytes),
- well-developed understory flora, and
- multi-layered canopies.

Examples of classification systems that include some of these concepts are “large-diameter, high-basal-area stands” as defined by Maine Department of Conservation (2003) or “large sawtimber” stands as defined by DeGraaf et al. (1992). Ecologically mature forest communities on sites subject to periodic stand-replacing disturbances, such as spruce-fir flats, may be relatively small in diameter and have low species diversity. On these sites late-successional forest may be indicated by a high density of legacies from the pre-disturbance stand.



*Lungwort lichen (Lobaria pulmonaria) is common in late-successional northern hardwoods. Photo: John Hagan*



*Gray horsehair lichen (Bryoria capillaris) is common in late-successional spruce-fir mixedwood stands. Photo: Andrew Whitman*

# Late-Successional Forest Species

## Management:

- ✓ Retain late-successional stands when present or allow them to develop if absent. Current research suggests that late-successional characteristics can be maintained in many stands through periodic light partial harvesting.
- ✓ In stands managed with even-aged methods, it may be possible to maintain some late-successional elements if late-successional patches are retained until the new stand is mature.
- ✓ Use the Late-Successional Index currently under development by the Manomet Center for Conservation Sciences ([www.manometmaine.com](http://www.manometmaine.com)) to identify late-successional stands.
- ✓ Surround late-successional stands with a buffer that maintains continuous forest cover.
- ✓ Little is known about late-successional species in oak-pine or northern white cedar forests. Given the evidence from northern hardwoods and spruce-fir, it seems likely that there are late-successional species associated with these types. Allow a small percent (up to 10%) of these stands to develop late-successional characteristics.

## Habitat Use:

| Forest Ecosystems |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |   |            |   |   |   |   |                | Special-value Habitats |  |  |                          |             |
|-------------------|---|---|---|--------------------|---|---|---|---|----------|---|---|---|---|---------|---|---|---|------------|---|---|---|---|----------------|------------------------|--|--|--------------------------|-------------|
| Aspe -Birch       |   |   |   | Northern Hardwoods |   |   |   |   | Oak-Pine |   |   |   |   | Hemlock |   |   |   | Spruce-Fir |   |   |   |   | N. White Cedar |                        |  |  | Riparian/ Wetland Forest | Vernal Pool |
| R                 | S | I | M | R                  | S | I | M | L | R        | S | I | M | L | I       | M | L | R | S          | I | M | L | I | M              | L                      |  |  |                          |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |   |            |   |   |   |   |                |                        |  |  |                          |             |
|                   |   |   |   |                    |   |   |   |   |          |   |   |   |   |         |   |   |   |            |   |   |   |   |                |                        |  |  |                          |             |

R

S

I

M

L

Mx

U

C

?

Focus habitat

Other habitat

Little/no use

Regeneration and seedlings

Saplings and small poles

Intermediate-aged forest

Mature forest

Late-successional forest

Mixed conifer-deciduous

Understory present

Cavity tree or snag

More research needed

**References:** DeGraaf et al. 2002, Foss 1999d, Whitman personal communication 2003, Selva 1994

**Table 3. Focus Species Summary Table**

| Development Stage      | Species and Region <sup>1</sup> | Primary Focus <sup>2</sup> | Forest Ecosystem |    |    |                    |   |    |          |    |    |         |   |   |            |   |   | Special-Value Habitats |                      | Preferred Habitat Features |                  |                                 |  |  |  |
|------------------------|---------------------------------|----------------------------|------------------|----|----|--------------------|---|----|----------|----|----|---------|---|---|------------|---|---|------------------------|----------------------|----------------------------|------------------|---------------------------------|--|--|--|
|                        |                                 |                            | Aspen-Birch      |    |    | Northern Hardwoods |   |    | Oak-Pine |    |    | Hemlock |   |   | Spruce-Fir |   |   | N. White Cedar         | Riparian and Wetland | Vernal Pool                | Extensive Forest | Snags, Cavities, Decay/Deadwood |  |  |  |
| Early Succession       | Species and Region <sup>1</sup> |                            |                  | R  | S  | I                  | M | R  | S        | I  | M  | L       | R | S | I          | M | L | I                      | M                    | L                          |                  |                                 |  |  |  |
|                        | Snowshoe Hare                   | ✓                          |                  | Mx | Mx |                    |   | Mx | Mx       | Mx | Mx | Mx      |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Ruffed Grouse                   | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Chestnut-sided Warbler          | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
| Mature                 | Eastern Towhee (S)              |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Magnolia Warbler                |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Fisher (S)                      | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Marten (N)                      | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | White-tailed Deer (N)           |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Northern Goshawk                | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Pileated Woodpecker             | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Black-backed Woodpecker (N)     |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Barred Owl                      |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Wood Thrush (S)                 |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
| Late Successional (LS) | Pine Warbler                    |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Black-throated Blue Warbler     |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Northern Redback Salamander     |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Late-successional Lichens       | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
| Riparian & Wetland     | Beaver                          |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Northern Waterthrush            |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Wood Turtle                     |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Northern Dusky Salamander       | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
| Vernal Pool (VP)       | Brook Trout                     | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Wood Frog                       |                            |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |
|                        | Spotted Salamander              | ✓                          |                  |    |    |                    |   |    |          |    |    |         |   |   |            |   |   |                        |                      |                            |                  |                                 |  |  |  |

**Development Stage**  
R Regeneration  
S Saplings and Small Poles  
I Intermediate-aged Forest  
M Mature  
L Late Successional

**Habitat Modifiers**  
Mx Mixed deciduous-conifer  
WP White pine required  
U Understory present  
? More research needed

**Habitat Use and Region**  
  
Focus species for this habitat type  
Utilizes these habitats  
Low frequency use or absent from this habitat

<sup>1</sup> Focus species region is statewide unless noted as S (south) or N (north)

<sup>2</sup> Primary Focus Species can be used to protect the greatest amount of biological diversity while managing for the fewest possible species. See Appendix 9 for recommendations on using this short list of focus species.



## 7. Stand-Level Management

This section presents general recommendations for stand-level management that should be implemented whenever applicable. These general recommendations compliment the recommendations for specific forest ecosystems, special-value habitats, and individual focus species.

### Snags, Cavity Trees, and Downed Woody Material

While traditional forest management has focused on growing vigorous trees for timber production, death and decay of trees is an important process of the forest ecosystem that provides habitat for a wide range of organisms.

#### Definitions:

- **Snags** are dead standing trees.
- **Cavity trees** are either live or dead trees with cavities used by wildlife.
- **Downed woody material** refers to dead branches or tree trunks on the forest floor.
- **Snag and cavity recruitment trees** are large live trees with decay that may become snags, cavity trees, or downed woody material.



#### Management Recommendations:

- ✓ Record numbers of snags and cavity trees as part of standard inventory practice.
- ✓ Selection management with a goal of large sawtimber production can be used to maintain a steady supply of snags, cavity trees, and downed woody material.
- ✓ With even-aged management, a combination of shelterwood-with-reserves, patch retention, and long rotations will generate the greatest amount of large deadwood and decaying trees, but volumes and habitat values may fluctuate widely over the course of a rotation.
- ✓ Protect downed logs on the forest floor.
- ✓ In spruce-fir stands, hardwoods provide a good opportunity to develop deadwood and snag goals.
- ✓ Leave tops at the stump or haul them back and distribute them through the stand if whole-tree harvesting.

| Maine Forest Service Goals for<br>Snags, Cavity Trees, and Downed Woody Material |                         |          |
|----------------------------------------------------------------------------------|-------------------------|----------|
| Deadwood and Decay<br>Component                                                  | Trees and Logs Per Acre |          |
|                                                                                  | ≥ 15 in.                | ≥ 21 in. |
| Snags                                                                            | 4                       | 1        |
| Snag and Cavity Recruitment<br>Trees                                             | 4                       | 1        |
| Downed Woody Material                                                            | 4                       | 1        |

| Number of Species Using<br>Snags, Cavity Trees, or Decaying Wood |                   |
|------------------------------------------------------------------|-------------------|
| Group                                                            | Number of Species |
| Mammals                                                          | 17                |
| Birds                                                            | 26                |
| Fungi                                                            | ???               |
| Insects and other Invertebrates                                  | ????              |

***Caution: Dead and decaying trees are very hazardous. If trees must be felled to comply with safety policies, leave the trees on the ground to provide habitat.***

**References:** Bryan 2003, Maine Forest Service 2003, Pelletier 1999b, Tubbs et al. 1987

## Patch Retention in Even-Aged Management

Shelterwood overstory removal harvests that occur when the regeneration is in the seedling or small sapling stage and clearcutting are inconsistent with natural catastrophic disturbances. Patches of forest left uncut in even-aged harvests will provide habitat refuges for small, animals with limited mobility (e.g., soil beetles) and plants that require closed-canopy forest. As the adjacent cut area matures, these animals and plants will be able to recolonize the adjacent stand.

- ✓ When clearcuts or overstory removal harvests exceed 10 acres in size, leave patches of the original stand exceeding at least 5% of the harvest area. Increase this percentage as the cut-block size increases.
- ✓ If clearcut separation zones are later harvested, increase the area in retained patches.
- ✓ Retained patches may be islands or peninsulas that extend in from adjacent stands.
- ✓ Use large snags or potential cavity trees as the nucleus of a patch.
- ✓ Use alternative silviculture (e.g. shelterwood-with-reserves) whenever possible.
- ✓ Patches over 1 acre in size have the best conditions for maintaining forest understory plants.
- ✓ Small-patch retention is not suitable for animals with larger patch-size requirements (e.g., marten). Consult species management guides (Section 6) and landscape-scale recommendations (Section 8) to be sure that the habitat needs of focus species are being met.

**References:** Pelletier 1999b, Whitman and Hagan 2000

## 8. Property-Wide and Landscape-Scale Forestry

Focus species management integrates management at both the stand and landscape scales by identifying a suite of species with different habitat requirements and territory sizes. Since some focus species like the marten and goshawk require suitable habitat conditions at the landscape scale, forest managers must consider how management of individual stands will affect the overall mix of forest age classes and types at the landscape scale. Small woodland owners cannot manage at the landscape scale, but they can manage at the overall property level, not just stand by stand, and adjust management based on surrounding landscape conditions.

Following are some basic principles of landscape-scale ecology.

### Habitat Loss and Fragmentation

**Habitat loss** is the conversion of one habitat type to another, for example the conversion of mature forest to young forest, or the loss of the forest itself when it is converted to development or agriculture. Forest harvesting may result in temporary loss of mature forest, but conversion to non-forest is permanent.

**Habitat fragmentation** occurs when a relatively large patch of habitat is cut into smaller patches. This may occur by **perforation**, which occurs when many smaller cuts are scattered throughout a large forest block, or when scattered homes are built in a forested area. The other end of the fragmentation spectrum is **isolation**, which occurs when harvesting or development results in habitat patches that are surrounded by large areas of dissimilar habitat. Studies have shown that habitat isolation is generally a greater threat than perforation, especially when the size of the remaining patch is small relative to the habitat needs of an animal.

**Habitat connectivity** is the inverse of habitat isolation, and occurs when patches of suitable habitat are located adjacent to one another or are connected by travel corridors.

Habitat loss and fragmentation typically occur together and may have a compounding effect, and scientists sometimes have a difficult time identifying which effect is the strongest.

### Habitat Interspersion and Large Forest Patches

**Habitat interspersion** occurs when different habitat types occur adjacent to one another. Some animals prefer a high level of interspersion in relatively small patches. For example, the ruffed grouse does best when three age classes in 1-10-acre patches ranging from regeneration to intermediate or mature stands are interspersed in a 10-50-acre area. In contrast, American marten

#### Stands and Landscapes

A **stand** is a unit of forestland typically delineated on the basis of species, size, and density of trees. Most forest management maps delineate forest stands. Stands typically range in size from a few acres to several hundred acres. Stand-level management is the fundamental building block of forestry and focus species management.

A **landscape** is a large-scale mosaic of forest stands and other non-forested community types and ecosystems such as bogs and streams. Landscapes may range in size from thousands of acres to tens of thousands of acres.



prefer areas of low habitat interspersion. Marten have a home range at least one square mile for females to two square miles or more for males where at least 70% of the area is in well-stocked intermediate and mature stands

For some species, patch size varies with the amount of suitable habitat in the landscape. For example, research by the Cornell Laboratory of Ornithology has shown that in fragmented landscapes where agriculture and development predominate and forests make up only 40% of the landscape, the scarlet tanager requires patches exceeding 600 acres for breeding, but when forests cover 70% of the landscape, patches as small as 66 acres may be suitable (Rosenburg et al. 2003).

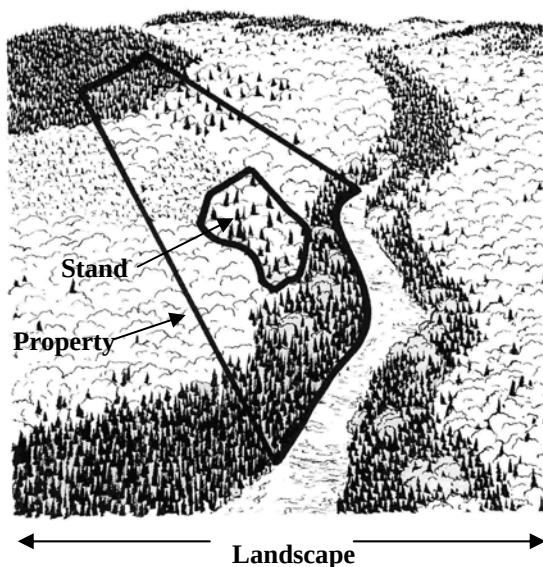
## General Recommendations for Landscape-Scale Management

### Landscape Planning Unit Size

- ✓ **Large Ownerships.** Establish landscape objectives and plans based on units ranging from perhaps 10,000 - 50,000 acres with 25,000 acres, the size of a typical township in the unorganized territory, suggested as a goal by the Maine Council on Sustainable Forest Management (MCSFM 1996). Watershed or township boundaries may be appropriate for delineating landscape-planning units.
- ✓ **Small Ownerships.** Consider the surrounding landscape when establishing objectives and plans for the overall property. DeGraaf et al. (1992) suggest looking at an area that is up to 10 times the size of the property.

### Analytical Techniques

- ✓ **Large ownerships:** Use inventory data to quantify the landscape by ecosystem type and development stage and summarize the data in a format similar to that shown in the focus Species Habitat Worksheet (Appendix 5). GIS also allows the analysis of the spatial distribution of these habitat types, and modeling software is becoming increasingly sophisticated at predicting future conditions.



*Focus species management integrates management at the stand, property, and landscape levels. Drawing: Andrea Sulzer*

- ✓ **Small Ownerships:** Map and quantify ecosystem type and special habitats for the property. For the surrounding area, use aerial photographs, Beginning with Habitat maps (see Section 3) and knowledge based on site visits to generally characterize the surrounding landscape. Summarize the landscape data in the landscape management table on the Focus Species Habitat Worksheet. Consider the following questions:

- Is the surrounding landscape mostly large-intermediate and mature forest, and is it likely to stay that way for foreseeable future? If so, providing some young forest habitat will enhance habitat diversity at the landscape level. In contrast, if the surrounding landscape is in very young stands, the best course would be to maintain as much old forest as possible.
- Does the ownership form part of a travel corridor in a developed or agricultural area?
- Is the property part of a relatively large block of forest for the area?
- Is the property adjacent to a special-value habitat, such as a deer wintering area?

Answers to these and similar questions can help inform management decisions for the property.

### Set Development-Stage Goals for the Landscape

To meet the needs of the full range of focus species, the landscape needs to provide adequate habitat for both early successional forest species (regeneration and sapling-small pole stages) and those that are characteristic of mature or late-successional stages. Refer to Table 2 for definitions of development stages. The following table can be used as a guide to setting landscape goals

| Landscape Goals for Stand Development Stages <sup>1</sup>        |                     |
|------------------------------------------------------------------|---------------------|
| Development Stage                                                | Landscape Goal      |
| Regeneration, Saplings and Small Poles                           | 5-30%               |
| Intermediate                                                     | Varies <sup>2</sup> |
| Mature                                                           | ≥ 20%               |
| Large-diameter mature stands (≥15 in. dbh) and Late Successional | ≥ 10%               |

<sup>1</sup> Adapted from DeGraaf et al. 1992, Maine Council on Sustainable Forest Management 1996, and draft recommendations of the Maine Forest Service Biodiversity Advisory Committee.

<sup>2</sup> The percent of landscape in intermediate stands is determined by the percent in other development stages.

### Create a Diversity of Patch Sizes

In most natural forest systems, including those found in Maine, small-scale openings caused by the death of individual or small groups of trees are much more common than large-scale stand-replacing disturbances (Seymour et al. 2002). This natural disturbance pattern, which is prevalent in many forests, plus the fact that some species prefer a high level of interspersed in small patches while others prefer large patches of comparatively uniform habitat as discussed above, lead Hunter (1990) to propose the following rule of thumb:

*Harvest forest at a range of different scales and allocate approximately equal areas to different points along the continuum from small scale to large.*

A useful corollary is:

*Avoid uniformity of treatments, both within stands and across the property.*

**Large Ownerships:** On a typical township in the unorganized territories, Hunter's rule would suggest that equal areas should be allocated to single tree and small group selection management (openings less than 0.25 acre), large group selection (0.25-2.5 acres), patch cuts and small shelterwood cuts or clearcuts (2.5-25 acres) and large shelterwood cuts or clearcuts (25-250 acres). Within the shelterwood and clearcut categories, applying Hunter's rule would suggest allocating equal areas to different opening sizes (e.g., the area in cuts from 25 to 75 acres should equal the area in patches from 75 to 250 acres).

**Small Ownerships:** Create a diversity of opening sizes appropriate to the ownership. Hunter (1999) suggests that the same general allocation approach used for large ownerships can be used on small parcels, but the maximum size of even-aged units (shelterwood or clearcut) will be much smaller than on large tracts of commercial timberland.

This approach to creating a diversity of patch sizes is probably best viewed as a conceptual model rather than a quantitative management prescription. It is a more aggressive approach to creating large patches than would occur under natural conditions, so should be used with caution. However, it is more conservative than much of the management seen today on industrial and investor timberlands. Individual stand conditions, landscape features, landowner objectives, and focus species habitat will take priority. Nonetheless Hunter's rule provides a useful context for evaluating the diversity of patch sizes in the current landscape and how that diversity will be impacted by management prescriptions.

### **Limit the Area in Single-Aged Stands**

If the harvests result in nearly complete overstory removal, the result will be a harvesting regime that is much more aggressive than that resulting from natural disturbance regimes. Even "stand-replacing disturbances" such as fire, wind, or spruce budworm result in irregular two-aged stands. In a review of silviculture and natural disturbance regimes in Maine, Seymour et al. (2002) observe that an artificial landscape pattern exists when even-aged stands exceed 15-25% of the landscape. The shelterwood-with-reserves method (see

### **Habitat Management and the Maine Forest Practices Act**

Maine's Forest Practices Act (FPA) limits the size of clearcuts and requires separation zones be retained that meet specified standards. Depending on the size of the clearcut, the separation zones can be harvested in approximately 10-15 years. Thus, clearcutting could be used to create large patches of early successional habitat consisting of a mosaic of stands that are separated by 10-15 years in age. Alternatively, under the FPA there is no limit on patch size that can be created with the shelterwood system. When even-aged management is used:

- Whenever possible, use shelterwood harvesting instead of clearcutting.
- Avoid a uniform application of similar-size harvest units evenly distributed across the landscape. See recommendations above on creating a balanced diversity of patch sizes, which will result in areas with high levels of habitat interspersed as well as a few large, relatively uniform patches.
- Follow the stand-level guidelines for retaining snags, cavity trees, downed logs and patches of older forest in even-aged management areas.
- Maintain travel corridors of mature forest in a landscape where shelterwood and clearcutting are used.
- Maintain adequate mature forest at all times, including some areas that do not "shift" across the landscape (i.e., areas where single-tree selection, group selection, or two-aged management are used).



Appendix 3) can be used to emulate natural stand-replacing disturbances, and guidelines for stand-level management (Section 7) should also be applied.

## **Develop the Landscape or Property-wide Plan**

Appendix 9 includes a short list of primary focus species for each region that can be used to help guide the landscape-planning process. Small woodland owners can use this list to develop property-wide plans. After the landscape or property plan is developed, stand prescriptions to meet specific habitat needs and management objectives can be developed.

### **All ownerships:**

- ✓ Map the property and landscape features as described in Section 3.
- ✓ Develop management prescriptions for riparian zones and other special-value habitats.
- ✓ Establish goals for landscape development stage and patch-size diversity as described above as well as the area in multi-aged (single-tree or group selection), two-aged (shelterwood-with-reserves), and single-aged stands (shelterwood with overstory removal or clearcut)
  - Multi-aged stands will maintain intermediate to mature conditions in a fixed location the landscape. This is important to plants that require mature forest conditions.
  - Two-aged and single-aged stands will cycle across a range of development stages, so the habitat they provide will move across the landscape.

### **Large Ownerships in the North Region:**

- ✓ **Mature forest:** Develop landscape plans that will provide on average at least 7 marten habitat units per township (for details see American marten, Section 6). This will define the minimum area in mature forest and intermediate stands over 40 ft. in height.
- ✓ **Early successional forest:** Manage for ruffed grouse and snowshoe hare in areas scheduled for regeneration harvests.
- ✓ **Late-successional forest:** Identify areas to be maintained for late successional character.

### **Small Ownerships:**

- ✓ Review the considerations under “Landscape Planning Unit Size” and “Analytical Techniques” earlier in this chapter.
- ✓ To the extent possible considering landowner objectives, stand conditions, and ownership size limitations, develop a property-wide plan that provides habitat for early successional, mature, and late-successional species.

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# Appendix 1. Recommended Resources

## Species Habitat Associations:

*New England Wildlife: Habitat, Natural History, and Distribution* by Richard DeGraaf and Mariko Yamasaki. University Press of New England, Hanover, NH. 482 p. This is the standard habitat reference for non marine New England birds, mammals, reptiles, and amphibians.

## Natural Communities:

*Natural Landscapes of Maine: A Classification of Vegetated Natural Communities and Ecosystems*, Maine Natural Areas Program, 2002. Not yet available for purchase.

*Natural Landscapes of Maine: Natural Community Keys and Profiles*, Maine Natural Areas Program, 2002. Not yet available for purchase.

## Biodiversity and Forestry:

*Biodiversity in the Forests of Maine: Guidelines for Land Management* by Gro Flatebo, Carol Foss, and Steve Pelletier. 1999. Manual Prepared for the Maine Forest Biodiversity Project. UMCE Bulletin #7147. University of Maine Cooperative Extension, Orono, ME. 168 pp. This manual was reviewed and edited by a committee of foresters, landowners, ecologists, and researchers and provides recommendations for stand and landscape-level biodiversity management and management of special habitats such as riparian zones, vernal pools, and deer wintering areas.

*Sustaining the Ecological Integrity of the Managed Forest: Principles and Practices for the Northeastern Forest Region* by Robert R. Bryan. Maine Audubon, Falmouth, ME. 4 p. This brochure provides an overview of concepts and practices for ecologically based forest management.

*Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity* by Malcolm L. Hunter, Jr. 1990. Prentice-Hall, Inc. 370 p. A practical text for foresters.

## Small Woodland Management

*Small Woodlot Owner's Handbook: a Comprehensive Resource*. Jeffrey Romano, editor. 2001. Small Woodland Owner's Association of Maine, Augusta, ME. 30 p.

## Wildlife and Development:

*Conserving Habitat in Maine's Developing Landscape* by Barbara Charry. Maine Audubon, Falmouth, ME. 8p. Reviews issues related to wildlife and development and identifies species of concern, and provides conservation recommendations.



## Vernal Pools

*Maine Citizens Guide to Locating and Documenting Vernal Pools.* 2003. Maine Audubon, Falmouth, ME. 96 p. Includes vernal pool indicators, including adults, eggs, larvae and dry-season indicators as well as a monitoring protocol.

*Forestry Habitat Management Guidelines for Vernal Pool Wildlife in Maine* by Aram Calhoun and Phillip deMaynadier. 2004. University of Maine, Orono; Maine Audubon, Falmouth; Maine Department of Inland Fisheries and Wildlife, Augusta; Maine Department of Conservation, Augusta. 36 p. Guidelines for forestry near vernal pools developed with input from ecologists and forest managers.

*Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Developments in the Northeastern United States.* 2002. University of Maine, Orono; Maine Audubon, Falmouth, Maine. 57 p.

## Reptiles and Amphibians

*Maine Amphibians and Reptiles*, edited by Malcolm Hunter Jr., Aram Calhoun, and Mark McCollough. University of Maine Press, Orono, ME. Natural history and range maps of all Maine reptiles and amphibians plus a CD with frog calls to aid in identification.

## Water Quality

*Best Management Practices for Forestry: Protecting Maine's Water Quality.* Department of Conservation, Maine Forest Service, 22 SHS, Augusta, ME 1-800-367-0223

## Other Species

New Hampshire Fish and Game Wildlife Profiles:  
[http://www.wildlife.state.nh.us/Wildlife/wildlife\\_profiles.htm](http://www.wildlife.state.nh.us/Wildlife/wildlife_profiles.htm)

- Beaver
- Black Bear
- Bald Eagle
- Little Brown Bat
- Eastern Coyote
- Fisher
- Moose
- Snowshoe Hare
- Eastern Wild Turkey
- American Woodcock

Woodcock: [www.umaine/mafes/ele\\_pubs/miscrepts/ne-woodcock.pdf](http://www.umaine/mafes/ele_pubs/miscrepts/ne-woodcock.pdf)

Thrushes: *A land manager's guide to improving habitat for forest thrushes* by Rosenberg et al. The Cornell Lab of Ornithology, Ithaca, NY. 29 p.

## Appendix 2. List of Focus Species Habitats and Associated Natural Communities

| Focus Species Habitat Classification | Maine Natural Areas Program Natural Community Types                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aspen-Birch                          | Aspen-birch woodland/forest complex (S5)                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Northern Hardwoods                   | Beech-birch-maple forest (S4)<br>Maple-basswood-ash forest (S3)<br>Spruce-northern hardwoods forest (beech, yellow birch, and sugar maple > spruce and fir) (S4)                                                                                                                                                                                                                                                                                               |
| Oak-Pine                             | Oak-pine forest (S4)<br>Red oak-northern hardwoods-white pine forest (S4)<br>White oak-red oak forest (S2)<br>Red-pine-white pine forest (S3)<br>White pine-mixed conifer forest (hemlock co-dominant) (S4)                                                                                                                                                                                                                                                    |
| Hemlock                              | Hemlock forest (S4)                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Spruce-Fir                           | Maritime spruce-fir forest (S4)<br>Fir-heart-leaved birch subalpine forest (typically > 2700 ft.) (S2)<br>Spruce-fir-wood sorrel-feather moss forest (montane, up to 2500 ft.) (S4)<br>Spruce-fir-broom-moss forest (lower elevation) (S4)<br>Spruce-fir-cinnamon fern forest (wetland) (S4)<br>Spruce-northern hardwoods forest (spruce and fir > beech, yellow birch, and sugar maple) (S4)<br>White pine-mixed conifer forest (red spruce co-dominant) (S4) |
| Northern White Cedar                 | Northern white cedar swamp (flat with peat accumulation) (S4)<br>Cedar-spruce seepage forest (gently sloping) (S3)                                                                                                                                                                                                                                                                                                                                             |
| <b>Special-value Habitats</b>        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Riparian and Wetland Forest          | Red maple-sensitive fern swamp (S4)<br>Silver maple floodplain forest (S3)<br>Hardwood river terrace forest (S2)<br>Hardwood seepage forest (S3)<br>Other communities listed above that border streams, rivers, and lakes                                                                                                                                                                                                                                      |
| Vernal Pool                          | None                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### Maine Natural Areas Program Rankings:

- S1: Critically imperiled in Maine because of rarity (5 or less occurrences) or because it is especially vulnerable to extirpation
- S2: Imperiled in Maine because of rarity (6-20 occurrences or few remaining acres) or because other factors make it vulnerable to further decline
- S3: Rare in Maine (on the order of 20-100 occurrences)
- S4: Apparently secure in Maine
- S5: Demonstrably secure in Maine

## Appendix 3. Overview of Silvicultural Systems

**Single-tree Selection:** Single-tree selection is a method of creating and maintaining an all-aged stand (typically 3 or more age classes separated by 20 or more years) by marking and removing individual trees. Removals, which typically occur at 15-25-year intervals, are designed to balance age and diameter classes of trees in the stand and encourage regeneration. This method works best for regenerating shade-tolerant species such as sugar maple, beech, hemlock, red spruce, and northern white cedar. Single-tree selection may be used to maintain a relatively continuous forest canopy and understory layers that benefit a range of mature-forest wildlife and plant species. Many stand are even-aged due to past land use history, conversion to an all-aged stand must be carefully planned.

**Group Selection:** Group selection is a method for creating and maintaining an all-aged stand by marking and removing groups of trees on a periodic basis. Removals may range from groups of 3-4 trees, sometimes called “small group selection,” to openings of 0.5-2 acres in size (“large-group selection”) and may occur on a 15-20 year cycle. This method works well for both shade-tolerant and mid tolerant tree species. It is an excellent method for encouraging species such as yellow birch and white ash in northern hardwoods and can be used for pine-oak, spruce-fir, hemlock, and northern white cedar. As with single-tree selection, conversion of even-aged stands to all-aged stands must be carefully planned.

Because it results in small patches of early successional habitat within a relatively mature forest matrix, group selection is a good method to maintain habitat diversity on small ownerships. A mixture of group selection and individual-tree selection is consistent with the natural disturbance regimes of northern hardwoods, hemlock and cedar as well as spruce-fir on sites with relatively deep, well-drained soil.

**Shelterwood:** The shelterwood method is used to regenerate the entire stand within a short period of time under a partial forest canopy. Typically 30-50% of the canopy is removed in the initial entry to stimulate regeneration. The canopy may be removed in one or two subsequent entries over the next 10-20 years once the regeneration is established, or it may be retained for an extended period of time. The latter approach is called **shelterwood-with-reserves**, is used to develop and maintain a two-aged stand. By varying the level of canopy removal, the shelterwood method can be used to regenerate most forest types.

The shelterwood method can be used to create large patches of early successional habitat while avoiding many of the negative aspects of clearcutting. By retaining patches of mature trees within a harvest block or using the shelterwood-with-reserves approach, the shelterwood method can be used to emulate natural disturbances associated with wind, fire, or insects characteristic of oak-pine forests, spruce-fir flats, high-elevation spruce-fir, and spruce-fir on sites where windthrow is a high risk. However, long rotations (e.g., greater than 70 years in spruce-fir, greater than 100 years in northern hardwoods or oak-pine) are necessary to develop mature forest conditions such as large live trees, snags, cavity trees, downed logs, and multiple canopy layers. It may be possible to speed development of mature forest conditions by retaining large, long-lived trees and encouraging regeneration during intermediate entries.

**Clearcutting:** Clearcutting can be used to regenerate all forest types, but it is the least natural of all silvicultural systems. Concerns with clearcutting include the decay of organic matter and loss of nutrients due to high temperatures, soil disturbance, loss of understory plants that are sensitive to the harsh conditions of a clearcut, and loss of older trees that might be left after a natural disturbance. Where conifer regeneration is the objective, the use of herbicides is often necessary to achieve management goals. From an ecological perspective, clearcutting should only be used when it has been determined that management objectives cannot be attained with other silvicultural systems. When clearcuts must be used, their impacts can be mitigated by scattering tops and branches across the site, maintaining patches of



older forest in islands and peninsulas, using extended rotations, and maintaining the majority of the landscape in intermediate and mature forests.

**Crop-Tree Management:** Crop-tree management focuses on selecting and releasing the crowns of individual trees that are desirable to meeting a landowner's objectives (Perkey et al. 1993). It is generally used on small ownerships, but is also appropriate to larger ownerships where individual tree marking is applied. When the crop trees are mature the other silvicultural tools described above can be used to regenerate the stand. The choice of regeneration method will vary with landowner objectives, ecological objectives, forest type, and condition.

## Appendix 4. Other Special-value Habitats

Focus species management is designed as a tool to help guide management of the bulk of the landscape and a vast majority of species commonly encountered by forest managers. However, focus species management may not account for rare species with unique habitat requirements, rare forest types, species that are highly sensitive to timber harvesting, or other specialized habitats. Landowners should also integrate management of these important ecological features into the management plan for their property.

| Element                                                                                                                                                                 | Description                                                                                                                                                                                                                                                                                     | Information Source/Management                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rare, threatened, or endangered plants                                                                                                                                  | Plants listed under the federal Endangered Species Acts and other species listed S1, S2, or S3 by MNAP <sup>1</sup>                                                                                                                                                                             | Maine Natural Areas Program<br><b>Good:</b> Protect known occurrences. Foresters should be able to identify rare forest communities.                                                                                                                   |
| Threatened or endangered animals                                                                                                                                        | Animals listed under the federal and Maine endangered species acts                                                                                                                                                                                                                              | <b>Better:</b> Manage appropriately if MNAP data suggests possible occurrences.                                                                                                                                                                        |
| Rare or exemplary natural communities                                                                                                                                   | Natural communities classified as S1, S2, or S3 or “exemplary” communities                                                                                                                                                                                                                      | <b>Best:</b> Conduct on-site surveys                                                                                                                                                                                                                   |
| Old growth forests                                                                                                                                                      | Stands over 150-200 years old with light harvest history                                                                                                                                                                                                                                        | Protect existing stands and allow some additional old growth to develop.                                                                                                                                                                               |
| Significant wildlife habitat                                                                                                                                            | Threatened or endangered species habitat, high- and moderate-value deer wintering areas and travel corridors; high- and moderate-value waterfowl and wading bird habitat; Atlantic salmon spawning and nursery areas; and other non-forest areas listed by the Natural Resources Protection Act | Maine Department of Inland Fisheries and Wildlife (MDIFW) or Maine Natural Areas Program. Mapped Significant Wildlife Habitats are protected by law. Protection of unmapped habitats is voluntary unless within a wetland or other protected resource. |
| Deer wintering areas                                                                                                                                                    | Spruce, fir, cedar or hemlock stands with >50% crown closure and >30 ft. tall with historical deer “yarding”                                                                                                                                                                                    | Review Beginning with Habitat map. Consult with regional MDIFW biologist.                                                                                                                                                                              |
| Heron Rookeries                                                                                                                                                         | Look for concentrations of large stick nests, usually in hardwoods (occasionally softwoods), near rivers, wetlands, or on islands.                                                                                                                                                              | MDIFW                                                                                                                                                                                                                                                  |
| See <i>Biodiversity in the Forests of Maine: Guidelines for Land Management</i> (Elliott 1999) for more information on identifying and managing these special habitats. |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |

<sup>1</sup> Maine Natural Areas Program (MNAP) classifies rare plants and natural communities with the following system:

- S1: Critically imperiled in Maine because of rarity (5 or less occurrences) or because it is especially vulnerable to extirpation
- S2: Imperiled in Maine because of rarity (6-20 occurrences or few remaining acres) or because other factors make it vulnerable to further decline
- S3: Rare in Maine (on the order of 20-100 occurrences)
- S4: Apparently secure in Maine
- S5: Demonstrably secure in Maine

## Appendix 5. Focus Species Data Forms

**Note:** Blank forms are available in Word, Excel, and PDF format at:  
<http://www.maineaudubon.org/conservation/forest/index.shtml>.

See Appendix 6 for examples of completed forms



## Forest Species Management Planning Checklist

Property:

Compartment:

Prepared by:

Date:

| Focus Species Management Planning Checklist  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Com-<br>pleted<br>(Y/N)                      | Information/Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Notes |
| <b>Background Data</b>                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |
|                                              | Landowner objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |
|                                              | Aerial photographs: property and surrounding landscape                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |
|                                              | Property map with stands, special-value areas, and cultural features                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |
|                                              | Stand data (species, DBH, development stage, snags and cavity trees, + timber-related data)                                                                                                                                                                                                                                                                                                                                                                                                                        |       |
|                                              | Location of stream and wetlands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |
|                                              | Rare, threatened or endangered species                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |
|                                              | Special value areas located on map<br><input type="checkbox"/> Riparian zones<br><input type="checkbox"/> Vernal pools<br><input type="checkbox"/> Rare or exemplary natural communities<br><input type="checkbox"/> Old growth forest<br><input type="checkbox"/> Significant Wildlife Habitat<br><input type="checkbox"/> Deer wintering areas<br><input type="checkbox"/> Heron rookeries<br><input type="checkbox"/> <i>Beginning with Habitat</i> large forest blocks<br><input type="checkbox"/> Other _____ |       |
| <b>Focus Species Planning and Management</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |
|                                              | Classify forest stands by focus species ecosystem and development stage and summarize data on the Focus Species Habitat Worksheet.                                                                                                                                                                                                                                                                                                                                                                                 |       |
|                                              | List focus species for property                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |
|                                              | Identify mix of forest development stages and management activities (see objectives and recommendations summary form)                                                                                                                                                                                                                                                                                                                                                                                              |       |
|                                              | Integrate landowner objectives with focus species objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |
|                                              | Develop short and long-range management plan                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |
|                                              | Implement plan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |
|                                              | Monitor habitats and species                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |
|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |

See Section 3 for sources of data

## 82

8282

## Species Forestry

## Species Forestry

## Species Forestry

# Focus Species Management Worksheet

Property \_\_\_\_\_ Date \_\_\_\_\_

Compartment \_\_\_\_\_

Enter acres or check box below each habitat type present. Shaded boxes are focus species for that habitat type. Put an "X" in each box to indicate the focus species for the property. Refer to species profiles for habitat needs and management recommendations. Snowshoe hare is focus species in aspen-birch and northern hardwoods only if low conifer cover is present (see species guide).

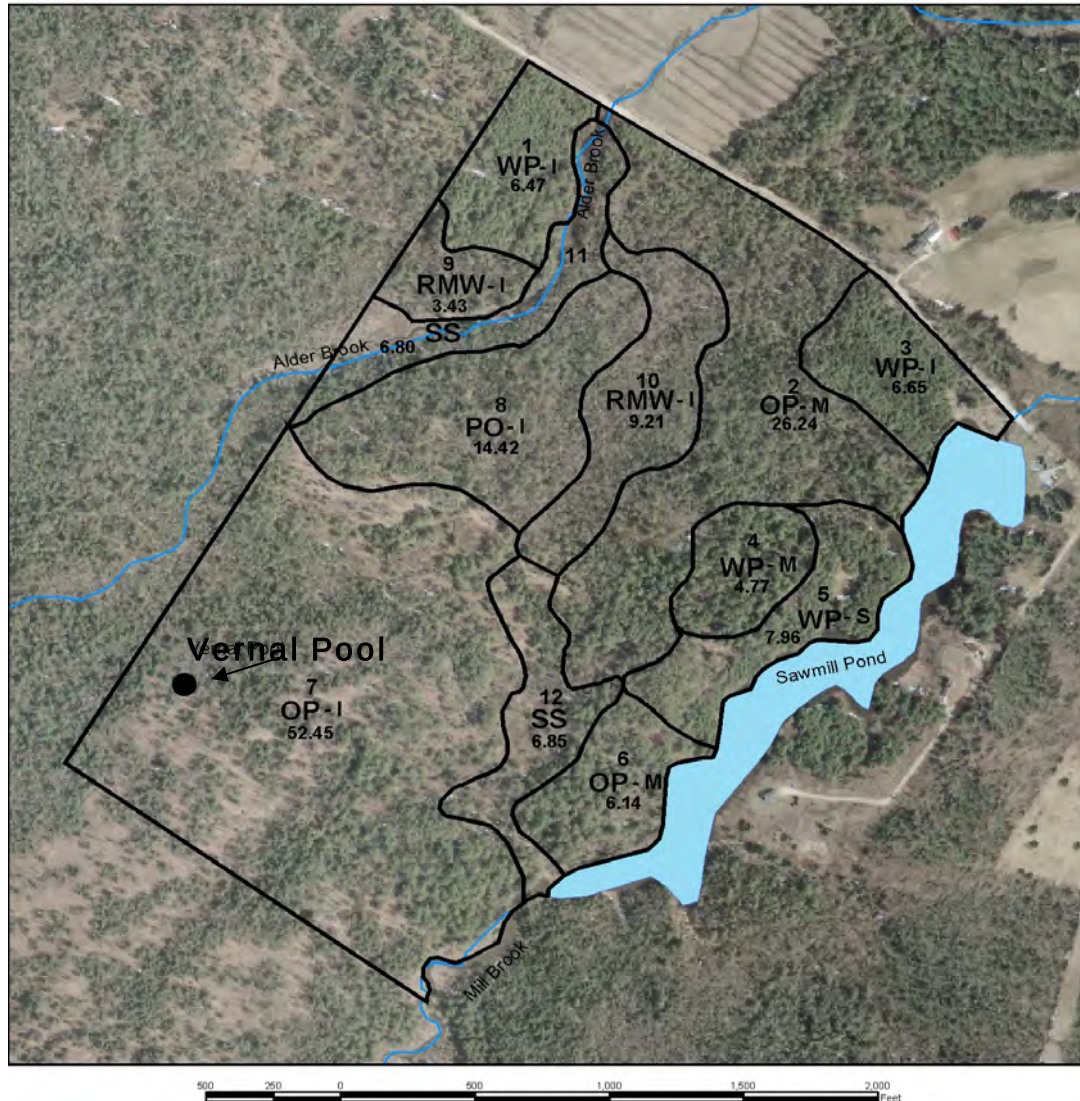
## Summary of Management Objectives and Recommendations

| Dev. Stage        | Species & (Region)<br>(Primary Focus Species shown in bold) | Ecosystem or Special-Value Habitat |    |     |    |     |         |     |    | Habitat |  |
|-------------------|-------------------------------------------------------------|------------------------------------|----|-----|----|-----|---------|-----|----|---------|--|
|                   |                                                             | A-B                                | NH | O-P | HE | S-F | NW<br>C | R&W | VP |         |  |
| Early Succession  | <b>Snowshoe hare</b>                                        |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Ruffed grouse</b>                                        |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Chestnut-sided warbler</b>                               |                                    |    |     |    |     |         |     |    |         |  |
|                   | Eastern towhee (S)                                          |                                    |    |     |    |     |         |     |    |         |  |
|                   | Magnolia warbler                                            |                                    |    |     |    |     |         |     |    |         |  |
| Mature            | <b>Fisher (S)</b>                                           |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Marten (N)</b>                                           |                                    |    |     |    |     |         |     |    |         |  |
|                   | White-tailed deer (N)                                       |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Northern goshawk</b>                                     |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Pileated woodpecker</b>                                  |                                    |    |     |    |     |         |     |    |         |  |
|                   | B.B. Woodpecker                                             |                                    |    |     |    |     |         |     |    |         |  |
|                   | Barred owl                                                  |                                    |    |     |    |     |         |     |    |         |  |
|                   | Wood thrush (S)                                             |                                    |    |     |    |     |         |     |    |         |  |
|                   | Pine Warbler                                                |                                    |    |     |    |     |         |     |    |         |  |
|                   | B.T. blue warbler                                           |                                    |    |     |    |     |         |     |    |         |  |
| Late Successional | N. redback salamander                                       |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Late-successional lichens</b>                            |                                    |    |     |    |     |         |     |    |         |  |
| Riparian & Wet    | Beaver                                                      |                                    |    |     |    |     |         |     |    |         |  |
|                   | Northern waterthrush                                        |                                    |    |     |    |     |         |     |    |         |  |
|                   | Wood turtle                                                 |                                    |    |     |    |     |         |     |    |         |  |
|                   | <b>Brook trout</b>                                          |                                    |    |     |    |     |         |     |    |         |  |
|                   | N. Dusky salamander                                         |                                    |    |     |    |     |         |     |    |         |  |
| VP                | <b>Spotted salamander</b>                                   |                                    |    |     |    |     |         |     |    |         |  |
|                   | Wood frog                                                   |                                    |    |     |    |     |         |     |    |         |  |



## Appendix 6. Example Stand Maps and Completed Worksheets

### Type Map with Ortho Photography



#### Ecosystem

WP - White Pine  
PO - Pine - Oak  
OP - Oak - Pine  
RMW - Red Maple Wetland  
SS - Shrub Swamp

#### Development Stage

R - Regeneration  
S - Sapling/Small Pole  
I - Intermediate  
M - Mature  
LS - Late Successional

March 29, 2004

Note: This is a hypothetical property for educational purposes only. Map based on public domain photography and GIS data only - no field cruise was undertaken.

# **Stand and Ecosystem Summary** **Mill Brook Forest, Chipville, ME**

| Stand       | Cover Type          | Forest Ecosystem   | Development Stage | Acres | Special Value Habitat                 |
|-------------|---------------------|--------------------|-------------------|-------|---------------------------------------|
| 1           | White Pine          | Oak-Pine           | I                 | 6.5   | Alder Brook riparian zone             |
| 2           | Oak-Pine            | Oak-Pine           | M                 | 26.2  |                                       |
| 3           | White Pine          | Oak-Pine           | I                 | 6.7   | Riparian zone along                   |
| 4           | White Pine          | Oak-Pine           | M                 | 4.8   | Sawmill Pond, Stands                  |
| 5           | White Pine          | Oak-Pine           | S                 | 8     | 2,3,5,6                               |
| 6           | Oak-Pine            | Oak-Pine           | M                 | 6.1   | Vernal pool, Mill Brook riparian zone |
| 7           | Oak-Pine            | Oak-Pine           | I                 | 52.5  |                                       |
| 8           | Pine-Oak            | Oak-Pine           | I                 | 14.4  |                                       |
| 9           | Red Maple           | Riparian & Wetland | I                 | 3.4   | Riparian and wetland                  |
| 10          | Red Maple           | Riparian & Wetland | I                 | 9.2   | Wetland                               |
| 11          | Shrub Swamp (Alder) | Non-forest         | na                | 6.8   | Riparian and wetland                  |
| 12          | Shrub Swamp (Alder) | Non-forest         | na                | 6.9   | Riparian and wetland                  |
| Total Acres |                     |                    |                   | 151.5 |                                       |

**Development Stage**  
 S Sapling-small pole  
 I Intermediate  
 M Mature

# Focus Species Habitat Worksheet

Property: Mill Brook, Chipville, ME      Compartment: East      Date: 4/1/2004      Forester: Vernal Poole

| Property level |                            | Forest Ecosystem (acres) |   |   |                   |   |   |          |   |   |         |   |   | Special-Value Habitats |   | Non-forest |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
|----------------|----------------------------|--------------------------|---|---|-------------------|---|---|----------|---|---|---------|---|---|------------------------|---|------------|----------------|---|---|----------------------|-------------|--------|-------|------|---|------|--|--|------|--|--|
| Stand Number   | Cover Type:<br>H, M, S, NF | Aspen-Birch              |   |   | Northern Hardwood |   |   | Oak-Pine |   |   | Hemlock |   |   | Spruce-Fir             |   |            | N. White Cedar |   |   | Riparian and Wetland | Vernal Pool | Y or N | acres | Type |   |      |  |  |      |  |  |
|                |                            | R                        | S | I | M                 | R | S | I        | M | L | R       | S | I | M                      | L | R          | S              | I | M |                      |             |        |       |      | L |      |  |  |      |  |  |
| 1              | S                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 2              | M                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 3              | S                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 4              | S                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 5              | S                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 6              | M                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 7              | M                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 8              | M                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 9              | H                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 10             | H                          |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 11             | NF                         |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| 12             | NF                         |                          |   |   |                   |   |   |          |   |   |         |   |   |                        |   |            |                |   |   |                      |             |        |       |      |   |      |  |  |      |  |  |
| Total:         |                            |                          |   |   |                   |   |   |          |   |   |         |   |   | 8                      |   |            | 80.1           |   |   | 37.1                 |             |        |       |      |   | 12.6 |  |  | 13.7 |  |  |

For additional stands insert new rows above

Enter stand number and cover type (Hardwood, Mixedwood, Softwood) above.

For each stand, enter the total acres under the appropriate ecosystem and development stage or special-value habitat. This property had only one non-wetland forest ecosystem (oak-pine), but multiple ecosystems can be entered on this sheet.

This worksheet is available in Excel format at <http://www.maineaudubon.org/conserve/forest/index.shtml>.  
Row and column totals and summary tables below are calculated automatically.

| Development Stage Summary-Acres |   |      |      |    |   |       |
|---------------------------------|---|------|------|----|---|-------|
| Cover Type                      | R | S    | I    | M  | L | Total |
| Hardwood                        |   |      |      | 13 |   | 12.6  |
| Mixedwood                       |   |      | 67   | 6  |   | 73    |
| Softwood                        | 8 | 13   | 5    |    |   | 26    |
| Total                           | 8 | 80.1 | 23.5 |    |   | 111.6 |

| Development Stage Summary- Percent |   |    |    |    |   |       |
|------------------------------------|---|----|----|----|---|-------|
| Cover Type                         | R | S  | I  | M  | L | Total |
| Hardwood                           |   |    |    | 11 |   | 11    |
| Mixedwood                          |   |    | 60 | 5  |   | 65    |
| Softwood                           | 7 | 12 | 4  |    |   | 23    |
| Total                              | 7 | 72 | 21 |    |   | 100   |

| Ecosystem Summary -Acres |          |      |      |      |   |       |   |      |
|--------------------------|----------|------|------|------|---|-------|---|------|
|                          | R        | S    | I    | M    | L | Total | % |      |
|                          | -acres - |      |      |      |   |       |   |      |
| Aspen-Birch              |          |      |      |      |   |       |   |      |
| N.N.Hardwood             |          |      |      |      |   |       |   |      |
| Oak-Pine                 | 8        | 80.1 | 37.1 |      |   | 125.2 |   | 83%  |
| Hemlock                  |          |      |      |      |   |       |   |      |
| Spruce-Fir               |          |      |      |      |   |       |   |      |
| N. White Cedar           |          |      |      |      |   |       |   |      |
| Riparian/Wetland         |          |      |      | 12.6 |   | 12.6  |   | 8%   |
| Non-forest               |          |      |      |      |   |       |   | 9%   |
| Total                    | 8        | 80.1 | 49.7 |      |   | 151.5 |   | 100% |

| Estimated Landscape % |     |    |     |     |
|-----------------------|-----|----|-----|-----|
| Cover Type            | R+S | I  | M+L |     |
| H                     |     | 15 |     | 5   |
| M                     | 5   |    | 15  | 5   |
| S                     |     | 15 |     | 5   |
| Sum                   | 5   | 45 |     | 15  |
| Developed             |     |    |     | 15  |
| Farm                  |     |    |     | 15  |
| Other                 |     |    |     | 5   |
| Total %               |     |    |     | 100 |



# Focus Species Management Worksheet

Property \_\_\_\_\_ Date \_\_\_\_\_

| Species & (Region)<br>(Primary Focus Species shown in bold) |                                  | Ecosystem or Special-Value Habitat |    |     |    |     |         |     | Summary of Management Objectives and Recommendations |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------|----------------------------------|------------------------------------|----|-----|----|-----|---------|-----|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                             |                                  | A-B                                | NH | O-P | HE | S-F | NW<br>C | R&W |                                                      | VP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Dev. Stage                                                  |                                  |                                    |    | 125 |    |     |         | X   | X                                                    | <p>Enter acres or check box below each habitat type present. Shaded boxes are focus species for that habitat type. Put an "X" in each box to indicate the focus species for the property. Refer to species profiles for habitat needs and management recommendations. Snowshoe hare is focus species for aspen-birch and northern hardwoods only when low conifer cover is present (see species guide).</p> <p><b>Summary of Management Objectives and Recommendations</b></p> <p>There is no early-successional habitat on the property at this time. Patches of low-grade oak and pine in Stand 7 provide an opportunity to improve stand quality and early-successional habitat Use the shelterwood method in 3- to 5-acre patches and large-group selection in 1- to 2-acre patches. Regenerate approximately 10 acres in 2004 and another 10 acres in 15 years. Use the area near the vernal pool (see below) and adjacent stands to provide the mature component of grouse habitat.</p> <p>The property is located in a forest block of over 1400 acres, large enough for goshawks and other mature forest species. The long-term goal is to maintain intermediate and mature conditions on a majority of the property. Manage for quality stems in intermediate stands (1, 3, 5, 6, and 7) with the crop tree method. Begin regeneration in Stand 2 in 2004 with a light initial shelterwood, harvesting at-risk and mature stems and leaving stems with best growth potential.. Use shelterwood with reserves on most of Stand 2; low quality patches may be suitable for overstory removal. Maintain downed logs, tip-up mounds, and cavity trees for fisher and other species. There are few large potential cavity trees now, so several large trees with decay should be identified retained on each acre and during harvests.</p> <p>Stand 4 has some old but low-quality pine. This stand could be set aside as a natural reserve area to allow late-successional conditions to develop.</p> <p>Maintain shade and protect water quality along Alder Brook, Mill Brook, and Sawmill Pond. Maintain potential cavity trees (hardwoods with decay) for wood ducks near Sawmill pond and in forested stands adjacent to the Alder Brook shrub swamp. Mill Brook has sandy banks and may have wood turtles. Alder Brook has a population of native trout, and there are fiddleheads in the floodplain.</p> <p>Spotted salamander egg masses were observed in April. Follow management guide for the vernal pool in Stand 7. Flag buffer prior to harvest (dry summer or frozen ground only).</p> |
| Early Succession                                            | <b>Snowshoe Hare</b>             |                                    |    |     |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Ruffed grouse</b>             |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Chestnut-sided warbler</b>    |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Eastern towhee (S)               |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Magnolia warbler                 |                                    |    |     |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Fisher (S)</b>                |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Marten (N)</b>                |                                    |    |     |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | White-tailed deer (N)            |                                    |    |     |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Northern goshawk</b>          |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Pileated woodpecker</b>       |                                    |    | X   |    |     |         | X   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | B.B. Woodpecker                  |                                    |    |     |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Barred owl                       |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Wood thrush (S)                  |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Pine Warbler (S)                 |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | B. T. blue warbler               |                                    |    |     |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | N. redback salamander            |                                    |    | X   |    |     |         |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| LS                                                          | <b>Late-successional lichens</b> |                                    |    | ?   | ?  |     | ?       |     |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Beaver                           |                                    |    |     |    |     |         | X   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Northern waterthrush             |                                    |    |     |    |     |         | X   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Wood turtle                      |                                    |    |     |    |     |         | X   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>Brook trout</b>               |                                    |    |     |    |     |         | X   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | <b>N. Dusky salamander</b>       |                                    |    |     |    |     |         | X   |                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| VP                                                          | <b>Spotted salamander</b>        |                                    |    |     |    |     |         |     | X                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                             | Wood frog                        |                                    |    |     |    |     |         |     | X                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## Appendix 7. Focus Species Associated with Extensive Forests

| Ecosystem                   | Region                                            |                                                         |
|-----------------------------|---------------------------------------------------|---------------------------------------------------------|
|                             | North                                             | South                                                   |
| Aspen-Birch                 | Northern goshawk                                  | Northern goshawk                                        |
| Northern Hardwood           | American marten<br>Barred owl<br>Northern goshawk | Fisher<br>Barred owl<br>Northern goshawk<br>Wood thrush |
| Oak-Pine                    |                                                   | Fisher<br>Barred owl<br>Northern Goshawk<br>Wood thrush |
| Hemlock                     | American marten                                   | Fisher<br>Wood thrush                                   |
| Spruce-Fir                  | American marten                                   | Fisher                                                  |
| Northern White Cedar        | Northern waterthrush                              |                                                         |
| Riparian and wetland forest | Northern waterthrush<br>Wood turtle               | Northern waterthrush<br>Wood turtle                     |

## Appendix 8. Focus Species Associated with Snags, Cavity Trees, or Downed Woody Material

| Ecosystem            | Region                                                                                       |                                                          |
|----------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------|
|                      | North                                                                                        | South                                                    |
| Aspen-Birch          | See footnote <sup>1</sup>                                                                    | See footnote <sup>1</sup>                                |
| Northern Hardwood    | American marten <sup>2</sup><br>Barred owl<br>Pileated woodpecker<br>Black-backed woodpecker | Fisher <sup>2</sup><br>Barred owl<br>Pileated woodpecker |
| Oak-Pine             |                                                                                              | Fisher<br>Pileated woodpecker<br>Barred owl              |
| Hemlock              | American marten                                                                              | Fisher<br>Pileated woodpecker                            |
| Spruce-Fir           | American marten<br>Black-backed woodpecker                                                   | Fisher                                                   |
| Northern White Cedar | Black-backed woodpecker                                                                      |                                                          |

<sup>1</sup> Because aspen and birch are typically too small for pileated woodpeckers and barred owls, no focus species associated with snags, cavity trees, and downed woody material were assigned to this type. However, because aspen and birch are prone to internal decay, they are valuable but short-lasting cavity trees for the many species that utilize smaller trees.

<sup>2</sup> Marten and fisher benefit from a variety of structures that provide cover for small mammals that are their prey, including downed logs, brush, stumps, root tip-up mounds, and other features.



## Appendix 9. Primary Focus Species for Maine

A short list of “primary” focus species has been identified for each region as a way to protect the greatest amount of biological diversity while managing for the fewest possible species. The species selected have one or more of the following characteristics:

- Highly dependent on a narrow range of stand-development stages or special habitats,
- Found in many or all of the forest ecosystem types common in the region,
- Large territory size (not typically applicable for habitat specialists of late-successional forests or special-value habitats), or
- Utilizes snags, cavity trees, decaying trees or downed, dead wood.

The following list covers all the forest ecosystem types, development stages, and special habitats featured in this guide.

### Primary Focus Species for Maine<sup>1</sup>

| Development Stages and Special-value Habitats                                     | Primary Focus Species                                                                              |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Early Successional Forest                                                         | Snowshoe hare<br>Ruffed grouse<br>Chestnut-sided warbler                                           |
| Mature Forest, plus Extensive Forests, Snags, Cavity Trees, and Downed, Dead Wood | American marten (north region)<br>Fisher (south region)<br>Northern goshawk<br>Pileated woodpecker |
| Late-Successional Forest <sup>2</sup>                                             | Lungwort lichen<br>Gray horsehair lichen                                                           |
| Riparian and Wetland Forest                                                       | Dusky salamander<br>Brook trout                                                                    |
| Vernal Pool                                                                       | Spotted salamander                                                                                 |

<sup>1</sup> Depending on habitat types present, not all species may apply.

<sup>2</sup> These species are examples only. Late successional species will vary with forest type and site. Many forest types and species groups have not been studied.

### Recommendations

- ✓ Within the range of American marten (the spruce-fir region of northern Maine), northern goshawks should be accommodated by marten management that includes both hardwood and spruce-fir stands.
- ✓ Where habitat fragmentation in southern and central Maine precludes the potential for nesting goshawks (forested blocks of less than 800-1,000 acres), use wood thrush as a primary focus species.
- ✓ If landowner interest and time allows, other “non-primary” focus species (see Section 6 and Table 3) can be used to broaden the management plan and/or tailor it to the landowner’s interest. Other species not covered in this manual (e.g., wild turkey,

woodcock) can also be incorporated into the plan. See Appendix 1 for sources of information on other species.

- ✓ See Section 6 for focus species profiles and management recommendations.

When using this list as a shortcut to focus species management, certain assumptions apply:

- The natural range of ecosystems on the property is maintained,
- Some stands are allowed to reach a late-successional stage,
- Stand and landscape recommendations (Sections 7 and 8) are applied, and
- Known rare species and other special-value habitats are protected (see Section 3, Step 2 for sources of information).

## Appendix 10. Examples of Stand Classification

| Stand 1 Basal Area (sq.ft./ac.) by Species |    |    |    |         |
|--------------------------------------------|----|----|----|---------|
| DBH                                        | RO | WP | He | All Sp. |
| <1                                         |    |    |    |         |
| 1-4.9                                      | 10 | 10 |    | 20      |
| 5-8.9                                      |    |    |    |         |
| 9-11.9                                     |    |    |    |         |
| 12-15.9                                    | 20 |    | 10 | 30      |
| 16-19.9                                    |    | 50 | 10 | 60      |
| ≥20                                        |    | 10 |    | 10      |
| Total                                      | 30 | 70 | 20 | 120     |

**Ecosystem:** Red oak (RO) and white pine (WP) have greater basal area than hemlock (He) so this is an Oak-Pine ecosystem.

**Development Class:** Basal area >20 in. is less than that in the 16-20 in. class and pine is dominant, so this is not potentially Late Successional; total >16 in. exceeds total <16 in. so this is a Mature stand.

| Stand 2 Basal Area by Species |    |    |    |         |
|-------------------------------|----|----|----|---------|
| DBH                           | RO | SM | Be | All Sp. |
| <1                            |    |    |    |         |
| 1-4.9                         | 15 | 5  | 10 | 30      |
| 5-8.9                         |    | 10 |    | 10      |
| 9-11.9                        | 10 |    | 15 | 25      |
| 12-15.9                       | 20 | 10 |    | 30      |
| 16-19.9                       |    |    | 5  | 5       |
| ≥20                           |    |    |    |         |
| Total                         | 45 | 25 | 30 | 100     |

**Ecosystem:** Even though red oak has the greatest basal area, sugar maple (SM) and beech (Be) have a greater total basal area, so this is a Northern Hardwood ecosystem.

**Development Class:** Basal area >12 in. (35 sq.ft.) is less than the basal area in trees less than 12 in., so this is not mature. Basal area >5 in. exceeds that less < 5in., so this is an Intermediate stand.

| Stand 3 Basal Area by Species |    |    |    |         |
|-------------------------------|----|----|----|---------|
| DBH                           | RO | WP | HE | All Sp. |
| <1                            | 5  |    |    | 5       |
| 1-4.9                         | 5  | 5  | 10 | 20      |
| 5-8.9                         |    | 10 |    | 10      |
| 9-11.9                        |    |    | 20 | 20      |
| 12-15.9                       |    | 10 |    | 10      |
| 16-19.9                       |    | 10 |    | 10      |
| ≥20                           |    |    | 20 | 20      |
| Total                         | 10 | 35 | 50 | 95      |

**Ecosystem:** Hemlock basal area is greater than pine and oak combined, so this is a Hemlock ecosystem.

**Development Class:** Hemlock and pine are dominant, but basal area >20 in. is less than smaller diameter classes so this not potentially Late Successional. Basal area >12 in. is less than lower classes, so this is not Mature. Basal area >5 in. is less than that <5 in. so this is an Intermediate stand.

### Notes:

- See Table 2, Stand Development Stages
- Diameter classes are for general guidelines only. Use professional judgment that considers site quality, species composition, stand history, and other characteristics in Table 2.
- Stands that meet the diameter range for “late successional” but are still growing in total volume and have relatively few dead or dying trees should be classified as “mature.” Likewise, older smaller-diameter stands that meet many of the other late successional characteristics in Table 2 should be classified as “late successional.” The age range from 100-125 years is generally the transition from mature to late successional.





MAINE AUDUBON

SPRING 2023

# HABITAT

## MAINE'S PRECIOUS Forests

### INSIDE

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2023 LEGISLATIVE PRIORITIES

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FEATURED SPRING EVENTS

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SPOTLIGHT: PLANNED GIVING



# MAINE'S PRECIOUS Forests

MAINE'S VARIED FORESTS are an invaluable treasure. Almost 90 percent of the state is forested, the highest percent of any state in the nation. They are globally significant—these forests provide not just timber and other forest products, but clean air and water, extensive habitat for both aquatic and terrestrial wildlife, and a myriad of recreational opportunities. They also play an important role in combating climate change by taking up and storing large amounts of carbon. But like so much of our landscape, Maine's forests are threatened by development, pollution, climate change, and the incursion of nonnative, invasive species. Just why are Maine's forests, especially older forests, so valuable? How does the composition of a forest affect the wildlife that live there? And how can we manage forests for the future, in order to provide habitat diversity, high quality fish and wildlife breeding and feeding habitat, and prepare for a changing climate? Read on to discover answers to these questions.

## MAINE'S FORESTS

# Growing older, getting better

BY MAC HUNTER

**R**ECALL THE OLDEST MAINE FOREST you have visited in the last year. Did you see sturdy, lofty trees holding up a vast canopy of foliage, so dense that you were bathed in subdued, filtered light? Was your visit so quiet and peaceful that you enjoyed feelings reminiscent of being in a cathedral or temple?

It may surprise you to know that your forest was probably not particularly old. It's likely that it only seemed old as measured by a human life span; by ecological standards it was probably just becoming mature. As forests reach maturity, they become profitable to cut for lumber and only a small portion are spared from logging. But if left in nature's hand, individual trees can live and grow for centuries, and the overall forest may persist for many centuries, even millennia, before a fire or wind storm will "set back the clock" for the entire forest in what ecologists call a stand-replacing disturbance.

As a forest ages there are important features that develop gradually, with no sharp line between a mature forest and what is often called "old growth."

This continuum of change, as a forest develops from mature to old growth, is reflected in an ever-changing cast of forest-dwelling species. Consider the height of the forest; mature forests are very tall as terrestrial ecosystems go, but old-growth forests are even taller and that means more microhabitats for more species. The sunny, windy top of a forest is a very different home for a lichen or insect than the dark, humid forest floor, so it harbors different species. Similarly, bigger, older trees have deeper fissures in the bark and are more likely to have cavities and areas of sloughing bark; all are potential habitats for myriad tiny species

and critical habitat elements for a few larger species, like bats and cavity-nesting birds.

The single most conspicuous feature of a really old forest is the abundance of deadwood, both standing snags and logs moldering away on the forest floor. Even young forests can have a lot of dead stems—saplings that lost the race to the sun—but only in an old-growth forest does one find massive snags and logs, tons and



tons of biomass. All that organic matter represents food for a staggering diversity of species from microbes and fungi on up the food chain. Consider a statistic for two families of beetles, the metallic wood-borers and long-horned beetles, that are uniquely tied to deadwood (it's their only habitat); globally, they comprise over 50,000 species. This is far more than the total for all birds, mammals, reptiles, and amphibians.

It may seem ironic that dying trees are the basis for so much life, but the story continues and takes us back to that earlier image of a cathedral-like mature forest with its somber light. The low light levels of a mature forest



limit the growth of understory herbs and shrubs and all the species that depend upon them, but when canopy-forming trees reach their lifespan they die and topple, leaving gaps that allow the sun to penetrate. Thus an old-growth forest has lots of vertical structure, that is, plants of different ages and sizes and heights, and their associated animals, thriving from top to bottom; they also have horizontal heterogeneity with many patches of younger forest dispersed within the older forest.

One species has a particularly complicated and diverse relation with old-growth forests: People. We love big, old trees and a whole forest full of them is a sight to behold, one that engenders deep spiritual feelings for many people. Some of these feelings are derived from aesthetics, some from feeling connected to something much larger and older than ourselves. Ecologists cherish old-growth forests because of their rich biodiversity and the insights they provide about how ecosystems change through time in response to climate and other things. We all know that tree rings help us understand the history of a tree, but did you know we can also measure the carbon found in a single cell of wood to estimate atmospheric concentrations from centuries ago and compare those to today's levels?

Finally, where do old-growth forests fit in discussions about climate change? It is widely accepted that old forests store far larger concentrations of carbon than younger forests, much of it in deadwood and soil. But what about their role in carbon *sequestration*, the on-going process of removing CO<sub>2</sub> from the atmosphere? A rapidly growing young forest does sequester more carbon each year than an old forest, but old forests do continue to sequester significant carbon. In short, from a carbon and climate perspective, it makes sense to have both young and old forests. More importantly, it certainly does not make sense to actively convert old forest to young forest because it may take centuries of carbon sequestration to compensate for the loss in carbon storage, and we don't have time to get on top of this issue.

So both older and younger forests have important

roles, as habitat for diverse species and for carbon management, but how much should we have of each? Since 1990, Maine has conserved millions of acres of forests; typically, these were recently cut forests and they will be conserved as "working forests" where sustainable forestry is practiced. Unfortunately,

relatively little of that conservation helped the situation with old-growth forests. Currently, 0.8% of Maine's forests are over 140 years old (an arbitrary, but reasonable age for defining old-growth in the Northeast). Compare that to the roughly 75% of Maine forests that were over that age before European colonization in the 1600s (based on research by Andrew Barton, University of Maine at Farmington). Over the last century, of those millions of acres of forests conserved, we have

set aside roughly 5% of Maine's forests in reserves like Baxter State Park where they will be subject to natural disturbances; eventually the majority of those acres will be over 140 years old. However, this is probably not enough to conserve the full array of Maine's forest biodiversity. We know we need to set aside lots and lots of old forest . . . 10%, 15%, 20%? Perhaps we can agree to have that debate after we pass 9%.

For now, we should protect all current stands that are more than 140 years old and start strategically designating many relatively old stands (80-140 years) to become old forest. Many of the remaining older stands are in riparian areas, where there are limits on logging under shoreland zoning, or scattered in difficult-to-access terrain. However, in recent years more of them are also being cut. Now is the time to proactively find and set aside these older forests, both to conserve our full array of wildlife species, and to store more carbon to counter climate change.

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Mac Hunter is an emeritus professor at the University of Maine who has written two books and many papers on the interface between forestry and wildlife conservation. The author would like to acknowledge Dr. Andrew Barton, professor of biology at UMaine Farmington, for his analysis of forest changes over time.

For now, we should protect all current stands that are more than 140 years old and start strategically designating many relatively old stands (80-140 years) to become old forest.

## MAINE'S FORESTS

# Think Globally, Manage Locally

Through forest management, we can help improve high quality breeding bird habitat by creating more mature, structurally complex forests that are vastly underrepresented across Maine today.

BY SALLY STOCKWELL

I AM LUCKY TO LIVE RIGHT NEXT DOOR to 900 acres of oak-pine forest. I walk or cross-country ski there almost every day. Come May, I eagerly wander through the woods looking and listening to determine which migratory birds have returned to my backyard and which residents are calling for mates and searching for nest sites. This community forest is one of the many small, medium,

and large forests across Maine that provide essential breeding habitat for more than 90 species of forest birds. Most are migratory, leaving Maine for the winter when food is scarce and returning each spring when trees leaf out and food becomes available once again.

These migrants are attracted to our expansive forestlands, which cover 90% of the state! They like our four different major forest types (oak-pine, northern hardwood, mixedwood, and northern softwood); the abundant food for their young (especially caterpillars); long days for gathering food; and a variety of habitat features for nesting, resting, hiding from predators, and raising young. Some species spend most of their time in the overstory (>30' high), others prefer the midstory (6-30' high), and still others are more comfortable close to the ground (<6' high).

The more structurally diverse the forest is, the more species and nesting pairs of each species you can pack in. Structurally diverse forests include habitat features such as at least three layers of vegetation, large old trees, small gap openings, dead standing and down

## Forest Layers

*Not to scale*

OVERSTORY (>30')

MIDSTORY (6-30')

UNDERSTORY (<6')





Note the trees in this oak-pine forest are all the same age/size, with little structural diversity. After thinning to allow more light to reach the forest floor, young white pines will grow and fill in the missing midstory.



Mature hardwood forest along a stream in Acadia National Park. Note the presence of multiple layers of vegetation, large and small trees, dead standing and down wood, and the stream—all of which increase habitat diversity.

wood, and a good layer of dead leaves on the forest floor. Different species use different parts of the forest for nesting and feeding. It's kind of like the diversity of an apartment building—lots of different homes and families live there as compared to a single-family home.

Geographic variation is also beneficial. A stream, wetland, or pond can increase habitat diversity considerably, bringing in water birds such as **Wood Ducks** and songbirds like **Veeries** or **Canada Warblers** that like to be near water. Mountainous terrain or boreal forests attract an entirely different suite of species, including **Blackpoll Warblers** and **Boreal Chickadees**.

Maine forests are so important for breeding forest birds that they have been dubbed “the baby bird factory” of the Atlantic flyway, and much of the North Maine Woods has been designated a globally significant Important Bird Area because of the number of both species and individuals that breed there. It is the largest intact northern temperate forest in North America, and possibly the world.

As a result, we have both an opportunity and a responsibility to provide high quality breeding habitat for these birds, and the many other fish and wildlife species that use similar habitat. We know that breeding birds across America have declined dramatically over the past 50 years. Today there are nearly 3 billion fewer birds than there were in 1970. Eastern forest birds have declined by 17% and boreal birds have declined by 33%. That means one in three boreal birds and one

in four eastern forest birds that used to be here are no longer gracing us with their bright and varied songs and colors.

## FORESTRY FOR MAINE BIRDS

The good news is that anyone who owns or manages a woodland here in Maine can help stall or reverse this trend by improving breeding bird habitat using active or passive management. Despite all the various threats breeding birds face across the Americas, the one thing we know for sure is that without more baby birds, their numbers will surely continue to decline. That's where Maine Audubon's Forestry for Maine Birds (FFMB) comes in.

Through the FFMB program, we have already reached 1649 foresters, landowners, loggers, land trusts, and other interested parties with tips for how to manage woodlands “with birds in mind.” Our emphasis is on creating more mature, structurally complex forests that most of our forest birds prefer but that are vastly underrepresented across Maine today. Older forests tend to have more tree species, trees of different ages and sizes, more vegetation in each of three layers, more dead standing and down wood, and more leaf litter than younger forests—all important for the 71% of breeding birds and other vertebrate wildlife that prefer mature forest characteristics. They also store more carbon and are more resilient to pests, disease, and climate change.

However, because much of the Maine forest is either recovering from the agricultural heydays of 70-80 years





**Intermediate-aged mixed wood stand. Note the small gap opening where young trees are now growing in the increased sunlight; over time this will create a mosaic of younger and older forest.**

ago, or has been harvested in the last few decades, the remaining forests are often relatively young. Trees are all the same age or perhaps of two different ages, and are not structurally complex—unlike the multi-aged, diverse 140-year-old or older forests that dominated at least 75% of the Maine landscape before Europeans settled here.

We will never return to the pre-settlement forest, but we can and should do better than just the 2 to 6% of Maine forests that are currently over 100 years old. However, old forests take time and patience to grow, while young forests naturally sprout after a harvest and many will be harvested again after 40-60 years, never allowed to grow old. That's why Forestry for Maine Birds goals mimic the characteristics of older forests that birds need, and recommend a mix of 40-50% of the larger landscape in older forest condition, at least 10% in the largest sawtimber size class, and only 10-20% in young forest and 20-40% in intermediate age forest.

## HANDY HABITAT ASSESSMENT

If you own or manage a woodland in Maine, or like to visit a forest in your community, you can readily determine its breeding bird habitat condition by conducting a simple "Handy Habitat Assessment." All you need are your ten fingers, five for live elements on one hand and five for mostly dead elements on the other hand—each finger representing a different habitat feature that's important to breeding birds. (Full details: [maineaudubon.org/ffmb](http://maineaudubon.org/ffmb).)

## PRIORITY SPECIES *and where they live*

### OVERSTORY

Some birds, like the **Blackburnian Warbler** and **Scarlet Tanager**, nest and sing high in the canopy.



*Blackburnian Warbler*



*Scarlet Tanager*

Photo: Doug Hitchcox

### MIDSTORY



*Yellow-bellied Sapsucker*

Photo: Richard Fournier

The **Yellow-bellied Sapsucker** and **Black-backed Woodpecker** build nests inside tree cavities.



*Black-backed Woodpecker*

Photo: Karen Hooper

### UNDERSTORY

The **Veery** and **Ovenbird** build and hide their nests near or on the ground.



*Veery*

Photo: Bill Benish



*Ovenbird*

Photo: Kirk Rogers

# Forest Conservation in Action

Today, many programs, management practices and strategies, and even carbon sales play a role in maintaining and enhancing our forests for people and wildlife. These include:

- **SUSTAINABLE FOREST CERTIFICATION PROGRAMS:** There are two major programs operating in Maine: the Sustainable Forestry Initiative (SFI) and Forest Stewardship Council (FSC). A landowner must meet certain management and business standards to become certified.
- **CONSERVATION EASEMENTS** can be donated and/or purchased from a private landowner. Certain “rights” are purchased and the landowner agrees to manage and care for their land in ways that meet the goals of the easement.
- **FEE ACQUISITION** by a conservation buyer gives the new landowner more certainty over how the lands and waters they care for will be managed.
- **ECOLOGICAL RESERVES AND FOREVER WILD** areas are places where natural disturbances and ecological processes are allowed to unfold without direct intervention from humans.
- **CARBON SALES:** Forests take up and store tremendous amounts of carbon. As carbon accumulates in the forest or long-term forest products, it can be monetized and sold as an “offset” for climate impacts.
- **ECOLOGICAL FORESTRY MANAGEMENT** focuses on mimicking natural disturbance regimes to maintain and enhance structural heterogeneity; retaining snags, old trees, and down logs; lengthening rotation times (time between harvests); creating landscape connectivity; protecting water quality; and enhancing biodiversity.

These tools are being put to use in numerous places around the state. For example, the **Mahoosuc Land Trust** and **Midcoast Conservancy** have multiple forest lands they own and numerous others they hold conservation easements on. Maine Audubon has worked with both land trusts to manage their woodlands using ecological forestry principles “with birds and other wildlife in mind,” and to design and place several informational signs at one of their properties designated as a Demonstration Forest.

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For details about these conservation tools and more, and to learn about other examples of projects in action, visit: [maineaudubon.org/maineforests](http://maineaudubon.org/maineforests).

This assessment can help guide any future forest management by identifying missing desirable habitat features and implementing harvesting strategies to enhance breeding habitat. By focusing on providing the various habitat features desired by 20 priority species we have illuminated in our Forestry for Maine Birds guides, landowners can provide breeding habitat not only for those 20 species but the many others that use similar habitat features. For example, if we provide cavity nest sites for a **Yellow-bellied Sapsucker**, we are also helping other woodpeckers such as **Downy, Hairy**, and **Red-bellied Woodpeckers**, and non-woodpeckers that also use cavities such as chickadees, titmice, nuthatches, and maybe even a flying squirrel, raccoon, or owl.

FFMB recommendations are fully compatible with other landowner goals, will help improve habitat for other iconic Maine species such as wild **Brook Trout** and **American Marten**, and can increase timber values and store more carbon by growing more live and dead old trees and valuable sawlogs over time.

## HELPING PRIORITY SPECIES

The 20 priority species were identified as species of conservation concern either because their population is in steep decline (e.g. **Wood Thrush**) or a large portion of its global breeding population breeds in northern forests (e.g. **Black-throated Blue Warbler**). These species are also relatively easy to identify both by sight and sound. If you search for them in early May before leaf-out is complete, you have a good chance of seeing them. Later in the season, you can picture who's hidden behind the leaves just by walking through the woods, listening to their songs.

It can be challenging at first but also rewarding to learn how to identify birds by their songs. Start with just a few. Once you watch a brilliantly colored **Northern Parula** singing from the top of a spruce tree, later on you'll be better able to match the song with the bird even if you can't see it. Of course, you can always cheat by using a remote recording device or Cornell's Merlin app to listen for you.

That's what we did when we posted “songmeters” at four different FFMB Demonstration Forests during 2019 and 2020 to learn more about which birds were found in each forest and if they were using the various habitat features targeted by FFMB (*see page 2 for more*). The results are encouraging. At Hidden





Clockwise from left: An informational sign at the Yankee Woodlot in Skowhegan; Sappi foresters learn about Forestry for Maine Birds; and workshop participants learn the Handy Habitat Assessment tool.

Valley Nature Center in Jefferson, a 1,000-acre diverse hardwood/softwood forest with wetlands, a pond, patches of older forest and recently harvested areas, the songmeters detected 98 different species at eight different stations, including five different woodpeckers in the stand where trees had been girdled to create more snags—a clear indication that more dead or decaying trees also means more woodpeckers!

At Sewall Woods in West Bath, a scraggly oak-pine forest, where several small gap openings were created to mimic natural disturbances, we recorded **Chestnut-sided Warblers** and **Eastern Wood-Pewees** using the gaps—just as predicted by FFMB! A total of 121 species were recorded at Sewall Woods. However, some of those species were heard from beyond the targeted habitat feature, from adjacent properties, or from flying overhead, so the total number is probably a bit inflated.

## WHAT'S IN YOUR WOODS?

When you walk through the woods, do you hear the strong “teacher teacher teacher” call of the **Ovenbird**? Have you heard the “zoo-zoo-zoo-zee-zet” of the **Black-throated Green Warbler** or the “Look at me, here I am, up in the tree” of the **Red-eyed Vireo**? Do you find tracks or signs of white-tailed deer, coyotes, fox,

fisher, porcupine, or otter? Maybe you’ll come across a vernal pool where wood frogs and spotted salamanders lay their eggs or hide underground in the surrounding forest after breeding. Perhaps you’ll see a lovely cold brook trout stream, full of aquatic insects, brook trout, and dusky salamanders as well.

When you hear or see signs of these animals, you can revel in knowing our fish and wildlife friends have a forest home—a place where they can find the food, nesting or denning sites, cover from predators, and water they need to thrive and raise their young. By creating a more diverse, structurally complex, multi-aged forest, we can provide habitat for many different species and families. We can all play an important role in stalling or even reversing the steep population declines we are seeing in many of our songbirds, reptiles and amphibians, fish, and insects.

*More: [maineaudubon.org/ffmb](http://maineaudubon.org/ffmb) to find guides for loggers, landowners, and foresters; a graphic illustration of a mature forest (along with who lives where) and a Handy Habitat Assessment; recorded presentations; videos; and dates and places for upcoming trainings and workshops.*

Sally Stockwell is the Director of Conservation at Maine Audubon.



# Conservation

## Listening and Learning

Do you like to listen to bird songs? We do too! But we don't like getting up at 3 or 4 am to drive to and walk in to the eight survey sites we established at four different Forestry for Maine Birds (FFMB) Demonstration Forests to do point counts. So, in 2019 and 2020, we placed remote audio recording devices (otherwise known as songmeters) at those sites to see if they could do the job for us. Volunteers helped us set up, move, and download the data from each site. The songmeters recorded hundreds of hours of bird songs during the dawn chorus over several weeks during the May-June breeding seasons to help us determine who was there. We also enlisted a few hardy volunteers who did get up and out very early in the morning to record what they heard at the same sites so we could test which method was more reliable.

It turns out that while experienced birders are pretty good at hearing most birds present at a given site, the songmeters picked up even more species. In all, we identified 131 species across the four Demonstration Forests using three different methods, ranging from 65-121 per forest. Fifty-two of those, including several of the FFMB 20 priority bird species, were recorded only by the songmeters—probably because they got to listen longer and over more days than people did! (However, these numbers may be a bit misleading, as the songmeters picked up birds from beyond the habitat featured at each survey point, as well as birds flying overhead.)

We had initially planned to use a specific software program to analyze the recorded data to identify bird species, but this proved challenging. Instead, volunteer birders listened to the recordings over the long winter months, transporting them back to greener days full of song. For those volunteers (thank you so much!), not being able to see the habitat, how far away the bird was, or where in the forest



**Maine Audubon's Tracy Hart and Sally Stockwell install songmeters at Kelley Woods, a forest managed by the 7 Lakes Alliance.**

the bird was singing, made it sometimes difficult to determine who was singing. Birders with visual cues could more easily determine if the bird they were hearing was tied to that site, farther away, or simply flying overhead.

Then, almost two years later, Cornell Lab of Ornithology released the BirdNET program, and this changed everything. BirdNET can process hundreds of hours of recordings in a relatively short amount





**The battery-powered songmeters can record for hundreds of hours.**

of time and produce a list of species heard, along with confidences for each identification. We used this technology to create a list of species heard at each survey point in each forest, and to try to tie that to the habitat features at each site—such as three layers of vegetation, snags, small canopy gaps, down wood, riparian areas, and leaf litter. A careful review of the data suggests we can get a pretty good list of all birds at each forest, and determine which are likely residents, which are likely migrants, and

which may be flyovers, but it's harder to determine which birds are actually breeding near those specific habitat features.

Now that we have BirdNet, we are excited about using songmeters to help determine how the overall species composition at a forest being managed “with birds in mind” changes over time in response to that management. We are already seeing some positive signs that this can work.

For example, girdling trees to become snags helped attract many woodpeckers and other cavity nesters at Hidden Valley Nature Center. Creating small canopy gaps at Sewall Woods attracted Chestnut-sided Warblers, Mourning Warblers, and Eastern Wood-Pewees. Based on BirdNet data, an older pond-side forest stand that had not been recently harvested at Woodbury Nature Sanctuary, featuring hardwood and softwood stands, riparian habitat, and a significant number of snags, supported 54 different species, confirming that structurally complex forests support a rich bird life. Other less structurally complex survey points had fewer species—such as the 24–28 species found at each of the eight survey points in the single-

aged, intermediate-aged hardwood forest stands at Kelley Woods.

We hope to return to these same four Demonstration Forests with songmeters, in years to come, to see if and how the species lists change over time in response to FFMB, and to use that data to adjust any management recommendations. Ultimately, the goal is to use this tool to enhance breeding bird habitat for the 20 FFMB priority species and the many other bird and wildlife species that use similar habitat.





# RESTORING OLD-GROWTH CHARACTERISTICS

to New England's *and* New York's Forests



The University of Vermont

ANTHONY D'AMATO

UMassAmherst

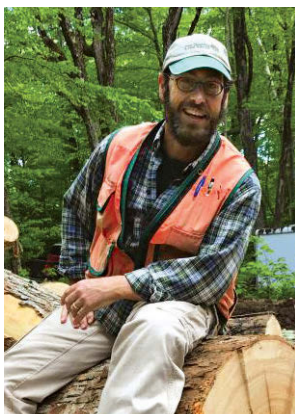
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This updated publication was initiated by the Vermont Land Trust to help address a growing need to inform current conversations regarding forest stewardship. We are grateful to them for advocating for this work, including attracting funding for it. We also greatly benefited from numerous conversations and feedback with the following advisory team:

Liz Thompson | *Vermont Land Trust*

Keith Thompson | *Vermont Department of Forests, Parks and Recreation*

Ali Kosiba | *Vermont Department of Forests, Parks and Recreation*

Caitlin Littlefield | *Conservation Science Partners*

David McMath | *Vermont Land Trust*

We are grateful to Shawn Fraver and Jordan Luff for providing data on old-growth structural conditions for northern hardwood–spruce mixed woods. We thank Soren Donisvitch for summarizing USDA Forest Service Forest Inventory and Analysis data to characterize current forest conditions in forests across New England and New York. We also thank Paul Strasburg for hosting our research plots on his land, enabling us to better understand strategies to restore old-growth characteristics, especially on family forest ownerships.

## REVIEWERS

We received invaluable feedback that greatly strengthened this publication from the following reviewers:

Barrie Brusilla | *Mid-Maine Forestry*

Louis Bushey | *Vermont Department of Forests, Parks and Recreation*

David Foster | *Harvard Forest, Harvard University*

Eric Hansen | *Ferrucci & Walicki, LLC*

Tom Lautzenheiser | *Mass Audubon*

Jon Leibowitz | *Northeast Wilderness Trust*

Amanda Mahaffey | *Forest Stewards Guild*

Rick Morrill | *Northern Forest Conservation Services, LLC*

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Wendy Weisiger | *Society for the Protection of New Hampshire Forests*

Robert Zaino | *Vermont Department of Forests, Parks and Recreation*

Chris Zimmerman | *The Nature Conservancy, New York Chapter*



**WE DEDICATE** this publication to our colleague, mentor, and friend David Kittredge, who was instrumental in motivating the original publication in this series, impressing upon us the importance of translating these concepts to the family-forest-owner-dominated landscapes of the Northeast.



## FUNDING

We are very grateful to the Open Space Institute, University of Vermont Rubenstein School of Environment and Natural Resources, University of Massachusetts Amherst, and Renewable Resources Extension Act (RREA) for their support of this publication and complementary outreach.

## PAPER SOURCING

At the time this pamphlet went to press, printing on 100% recycled paper was prohibitively expensive. Rather than wait, we elected to proceed with printing to meet the immediate need of evidence-based guidance about managing for old-growth forest characteristics. Both the expense and lack of availability of the paper products we would have preferred certainly speak to the supply-chain challenges rippling across all sectors of the economy. However, these dynamics also underscore the critical need for investments in wood and paper product recycling infrastructure—as well as in local forest product industries. As we show in this pamphlet, applying ecological forest management principles and practices can not only help achieve a diversity of forest conditions—from young to old forest characteristics—but be entirely consistent with the very investments needed to ensure the availability of sustainably sourced and recycled wood and paper products.

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## INTRODUCTION

The forests of New England and New York have long been recognized for providing myriad benefits, including clean air and water, wildlife habitat, recreational opportunities, and locally produced wood products. Increasingly, forests are being recognized as critical in addressing climate change, sparking even greater interest in our forests and stewardship strategies to conserve them. Maintaining this diversity of benefits necessitates a spectrum of stewardship strategies, ranging from intensive, active forest management to less intensive, passive approaches to forest stewardship. The forests of our past can help inform these forest stewardship strategies.

**FORESTS DOMINATED** about 90 percent of the region at the time of European settlement. In the nineteenth and early twentieth centuries, widespread land clearing for agriculture reduced forest cover to roughly 30 percent across much of the region. The last century and a half has witnessed an incredible rebound of our forests, which now occupy approximately 70 percent of the land base across New England and New York. However, even though our forests have grown back, there are few remaining examples of old-growth forests, which now occur on less than 0.1 percent of the region. Our current understanding of these remnant stands of old growth and historical accounts by foresters and ecologists tell us that these forests are quite different from the forests currently dominating our landscape. Since old growth is the condition that our forest species evolved with for thousands of years, maintaining old-growth characteristics within our forests restores missing pieces that will help ensure that our forests continue to sustain themselves and the many benefits we depend on.

We cannot re-create true old-growth forests; however, we have opportunities through both passive and active forest management to restore

old-growth characteristics to our ecologically young forests. New England and New York have a diverse ownership pattern, which includes a plurality of forest owned by families and individuals, with substantial ownership by public agencies and other private entities, including conservation organizations and the forest industry. Therefore, restoring old-growth characteristics widely will take a diverse set of strategies that match the goals of these ownerships and that can be applied to each on a landscape scale.

This publication is intended for the many decision-makers of these diverse ownerships, including family forest owners, public and private foresters, land trusts, and municipal officials. The goal of this publication is to increase the amount of old-growth characteristics in the region by giving decision-makers the information they need to adopt old-growth restoration strategies in ways that complement their ownership goals, helping to sustain our native forests and their many benefits. This publication builds on earlier guides (D'Amato and Catanzaro 2007, 2009) and provides a description of the importance of old-growth characteristics, the differences between current

## Regional Strategies to Conserve Forests, Young and Old

Permanently protecting the forests that form the natural “green infrastructure” of New England and New York is a priority of many agencies, organizations, and individuals. Most proposals guiding these efforts, such as *Vermont Conservation Design*, *Massachusetts Resilient Lands Initiative*, and *Wildlands and Woodlands*, recognize the value of protecting forests, using a variety of strategies, from wildland reserves to actively managed woodlands, to ensure that there are a range of forest conditions to support the diversity of biota, cultures, and livelihoods dependent on these forests. This includes designating areas to develop old-growth characteristics, as well as strategically creating young forests to provide habitat for declining wildlife species that depend on those conditions. A mix of strategies also helps to mitigate climate change, since young forests sequester (absorb from the atmosphere) carbon more rapidly and old forests store more carbon. Applying a variety of strategies will also increase forest resilience by creating diverse conditions across the landscape. Although the importance of wildlands has been acknowledged within these large-scale visioning efforts, there has been limited effort put toward the designation of these areas across the landscape. Applying strategies to restore old-growth characteristics on your land can not only help achieve your personal goals but also contribute to these regional efforts. In addition, family forest owners making formal long-term plans to ensure that their property remains forested into the future is crucial to the success of these regional efforts and benefits us all.

and old-growth forests, targets across New England and New York for old-growth characteristics, and management options for restoring these characteristics to our forests. In addition, this guide describes ways in which restoring old-growth characteristics complements efforts to adapt forests to global change, mitigate climate change through forest carbon, and promote biodiversity.

# WHAT IS OLD GROWTH?

**Old growth:** forests that were never directly affected by intensive human land use, such as those implemented by Europeans. Old growth is a very rare condition in New England due to the extent and impacts of agriculture, logging, and other land uses beginning in the colonial era. Cultural practices, such as the use of prescribed fire by Indigenous peoples, certainly influenced the condition of historic forests, particularly near villages and other settlements, but are considered harmonious with the natural processes that were the primary driver of these forests.

**Second growth:** forests that established and grew following intensive human land use, such as agriculture or logging of the colonial era. Most of the forests currently found in our region are best described as second growth.

**Old forests:** a forest that contains a critical mass of characteristics associated with old-growth forests (see Table 3, page 20, for target levels). Although specific forest ages have been included in definitions of old forest, the ecological time frames over which old-growth characteristics develop vary considerably by forest type, disturbance history, and site fertility. As a result, conservation strategies should focus on restoring tractable characteristics associated with old growth versus relying solely on estimates of tree age.



# WHY IS OLD GROWTH IMPORTANT?

Our current forests are much different from the forests our native plants and wildlife adapted with over thousands of years. Some plants, lichens, mosses, fungi, and invertebrate species are dependent on old-growth characteristics that are currently lacking or less abundant in our second-growth forests. Also, many species—particularly native birds, including some woodpeckers, warblers, and thrushes, as well as certain mammals, such as fishers and martens—have been shown to reach greater abundance in forests with old-growth characteristics, such as large trees with cavities and complex canopy structures. These abundant populations, called “source populations,” are crucial for populating or repopulating surrounding habitats and are therefore central to the long-term viability of our native species.

In the context of climate change, it is widely recognized that although they do not sequester carbon as quickly as younger forests, old-growth forests store the greatest amount of carbon. As such, mitigating climate change requires increasing the representation of forests with old-growth characteristics and functions on some parts of the landscape, while encouraging a diversity of other forest age classes on others. Finally, forests with old-growth characteristics support cultural traditions, providing human wellness benefits and the opportunity for spiritual renewal. These human values, in addition to the tangible ecosystem services these forests provide (water storage and filtration, localized cooling/climate buffering), underscore the importance of these forests to our well-being and even survival.

**Restoring these once common habitats is of central importance to conserving the full suite of our region’s native plants and animals and maintaining key ecosystem services, like carbon storage and water filtration, now and into a highly uncertain future.**



As we grapple with the challenges posed by global change, including changing climate conditions and a proliferation of non-native insects and diseases, there is great uncertainty regarding what conditions might provide the opportunities for forests to adapt to these changes and sustain the many benefits we currently derive from them. Encouraging more of the forest structure and species composition found in old-growth forests helps us keep every piece of the puzzle that our forests naturally evolved with, undoubtedly conserving crucial adaptation pathways and refugia that may provide opportunities for species and processes to persist under changing conditions. Therefore, restoring these once common habitats is of central importance to conserving the full suite of our region's native plants and animals and maintaining key ecosystem services, like carbon storage and water filtration, now and into a highly uncertain future.

**Forest structure:**

the spatial arrangement (vertical and horizontal) of the living (trees, plants) and dead (cavity trees, downed logs) components of a forest. This includes the diversity and abundance of different tree sizes, ages, arrangements, canopy layers, standing and downed dead trees, and forest openings.

**Forest composition:**

the proportion of tree species within a forest.

# OLD-GROWTH CHARACTERISTICS

Our region has a great diversity of forest types, ranging from the dominant oak-hickory forests in Connecticut and New York to the spruce-fir forests in northern Maine. Despite these differences in dominant species, there are common characteristics generally more abundant in old-growth forests, regardless of forest type. This section summarizes some of those key characteristics, which are often lacking in the second-growth forests you see today. The ecological functions of these characteristics and ways they can help a forest adapt to global change are presented in Table 1 (page 10).

**Presence of large and old trees.** The first characteristic that comes to many people's minds when thinking about old-growth forests is very big trees. It is common and understandable to relate a tree's size to its age. While in general, smaller trees are younger and larger trees are older, that's not always the case. A tree's height is related to the site's fertility: the more fertile the site, the taller the tree. A tree's diameter is more directly tied to how much space it's had to grow. Old-growth forests often have trees that are both large and old, though some old trees can have small diameters; for example, on

lower fertility sites and in areas of frequent natural disturbance, the living trees may all be relatively young. It takes time (decades or centuries) for large trees to develop, and correspondingly, a common characteristic used to differentiate old-growth forests from second-growth forests is the abundance of large-diameter trees (e.g., in old-growth northern hardwood forests, 12–20 trees per acre, each with a diameter at breast height [DBH] of at least 20 inches; see Table 3, page 20). In many respects, the intensive periods of land use occurring across the region in the nineteenth and early twentieth centuries reset this large-tree developmental clock, with many forests now lacking trees of these dimensions.

The life span of the long-lived tree species often found in old-growth forests (hemlock, sugar maple, red spruce, red oak) ranges from three hundred to more than four hundred years old. By comparison, our approximately one-hundred-year-old forests are ecologically young, which accounts for their lack of old-growth characteristics. Therefore, beyond their size, an important aspect of these old trees is their advanced age, which results in a high degree of tree-level complexity in terms of unique bark and branch patterns, which support a diversity of native



## Old-Growth Forest

- A. Gap in the forest created by a natural disturbance resulting in standing and downed deadwood. Increased light conditions will promote the release and establishment of young trees. These gap-scale events generate the spatial heterogeneity in tree densities and sizes that is a key characteristic of old-growth forests.
- B. Large-diameter (20"+ DBH) standing dead tree (snag).
- C. Large-diameter (20"+ DBH) overstory trees.
- D. Seedlings and saplings from a previous gap create multiple canopy layers, variation in tree size and density, and species diversity.

insects that birds forage on as well as perching habitats. In addition, these old trees often contain pockets of decay that serve as important points for the formation of cavities (holes), which serve as homes for a wide range of wildlife. In short, old trees show their age!

**Spatial variation in tree density and tree size.** Although big trees are the first characteristic many associate with old-growth forests, this emphasis on large trees actually hides a key attribute of all old-growth ecosystems: a high degree of variability across the forest in

terms of the size, age, and density of living and dead trees. This variability results from the long-term influence of natural disturbances, such as wind, insects, and disease, killing individual and groups of trees and creating a mosaic of canopy gaps and groups of different tree sizes and ages across the forest over time. This mosaic was likely reinforced in our fire-dependent ecosystems (e.g., pitch pine barrens and oak woodlands) by historic prescribed burning applied by Indigenous people, as well as more broadly across the landscape due to the influence of beaver activity prior to their widespread extirpation.



**Abundant downed deadwood in various sizes and stages of decay.** Natural tree death is an important ecological process, both in generating the openings in the forest canopy necessary for new trees to establish and in creating deadwood, which serves as critical habitats for many species and contributes to carbon storage, moisture retention, and soil protection. No attribute is more reflective of this long disturbance history than the high abundance of large downed logs found on the forest floor. It is estimated that old-growth forests often have at least two to four times the amount of dead downed wood on the forest floor than is typically found in second-growth forests.

A key characteristic of these downed logs is not just their abundance but also their range of decay. Downed logs are the consequence of periodic disturbances throughout time that killed trees in the forest, resulting in some logs that were recently killed and just beginning to decompose and others that are well-decomposed from disturbances decades ago. In addition, since there are often large trees in old-growth forests, the downed logs tend to be large in diameter, which makes them more resistant to decay. These attributes take decades to develop and thus are quite rare in our current forests. These downed logs provide habitat for organisms that break wood down, provide foraging

opportunities for other species, and serve as “nurse logs” for tree species that regenerate well on decomposing wood, such as hemlock, red spruce, northern white cedar, and black and yellow birch. Forests are diverse habitats, often including streams, wetlands, and vernal pools for which dead logs contribute a critical habitat role. Finally, these logs provide key ecosystem functions, including storing and cycling nutrients and carbon and moderating hydrology by retaining moisture.

**Large-diameter standing dead trees (snags).**

Although less abundant than downed logs, large-diameter standing dead trees—called “snags”—are also a common characteristic of old-growth forests. Snags serve a crucial role in providing foraging opportunities for birds (such as woodpeckers) that excavate the deadwood in search of insects. The holes that are created in the wood then serve as habitats for various birds and small mammals, with larger snags even supporting large





mammals, such as fishers, martens, and black bears. The presence of these large snags reflects the long-term legacies of natural disturbance, as well as the fact that some trees are able to live out their natural life spans in these forests, making them quite large. Given that our current forests are lacking many large-diameter living trees because of their relatively young age, large snags are even more uncommon.

**Multiple canopy layers.** The diffuse light and deep shade you often encounter when visiting an old-growth forest are a testament to the many layers of leaves that sunlight filters through in these ecosystems. That filtering (and absorption) of light is the product of centuries of canopy development, which has allowed slow advancement of trees of different species into different heights beneath the main canopy over time. The resulting layers of foliage, often extending from the forest floor to treetops, creates a habitat-rich space that includes hiding and nesting cover close to the ground as well as travel and gleaned corridors for certain birds and other species that use the highly connected upper canopy layers. The multiple layers of vegetation also provide opportunities to store more carbon in the forest.

**Regeneration.** A key aspect of the previously described canopy layers worth singling out is the well-developed regeneration layer found in old growth. This layer is typically dominated by seedlings and saplings of shade-tolerant species that thrive in low light conditions—like hemlock, sugar maple, beech, red spruce, and balsam fir—and have established themselves over time, often on well-decomposed logs or the forest floor. The presence of this existing “advance regeneration” before a disturbance to the forest canopy provides a key mechanism by which old growth and all forests recover following a disturbance event. A disturbance that kills the

overstory trees will allow the advance regeneration to grow into the main canopy and occupy the space vacated by the killed trees. Having established

regeneration increases the resilience of the forest by ensuring that the next group of trees that will occupy the site is already in place when a natural disturbance kills the overstory trees.

**Plant communities.** Few plant species only occur in old-growth forests; however, the abundance of dispersal-limited and sensitive species is often far greater in these forests given that it takes a long time for them to recover in areas cleared by historic land use, particularly agriculture. Examples of species occurring at greater abundance in older forests lacking past agricultural use include forest herbs, such as wild sarsaparilla, dwarf ginseng, wood sorrel, squirrel corn, and cucumber root, as well as lichens (like lungwort) and feather flat moss. Many of these species maintain their populations through either clonal growth or ant dispersal of seeds, making them quite sensitive to forest loss. Although you may find all these species in second-growth forests, they generally occur at much lower levels relative to old-growth forests. Similar dynamics are also observed with many fungal species, which either require a long period of time to develop extensive belowground networks in symbiotic associations with maturing and old trees, or are reliant on the large well-decomposed logs found in old-growth forests as substrates.



**TABLE 1** Common attributes associated with old-growth forests and linkages with key ecological functions and forest adaptation in the context of climate change and an increasing proliferation of non-native insects and diseases. General management strategies to restore and maintain these conditions in second-growth forests are also listed. Adapted from Keeton (2006); Bauhus, Puettmann, and Messier (2009); and D’Amato and Palik (2021).

| Old-Growth Attribute                                                 | Ecological Function                                                                                                                                                                                                                                                                                                                                                                                                                                       | Adaptation Mechanism                                                                                                                                                                                                                                                                                            | Management Strategies                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Presence of large and old trees</b>                               | <ul style="list-style-type: none"> <li>Food, shelter, and breeding habitat for wildlife</li> <li>Well-developed bark providing substrate for dispersal-limited taxa, such as lichens, lignicolous fungi, and mosses</li> <li>Perch sites for raptors</li> <li>Carbon storage</li> </ul>                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Conservation of regeneration options and genetic diversity (seed sources)</li> </ul>                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Crown thinning to accelerate large-tree growth</li> <li>Legacy tree designation of long-lived species to allow individual trees to live out natural life span</li> <li>Potentially focusing old forest work on high-quality sites, which provide high growth potential</li> </ul>                                                                     |
| <b>Spatial variation in tree density and tree size</b>               | <ul style="list-style-type: none"> <li>Diversity of habitats (gaps, closed canopy areas) and functional niches for wildlife species</li> <li>Microhabitats (light, temperature, moisture) supporting understory plant and regeneration development</li> </ul>                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Reduced vulnerability to disturbance (spatial variability in wind risk, fuels, drought stress)</li> <li>Multiple recovery and developmental pathways (regeneration in gaps, propagules from surviving mature trees)</li> </ul>                                           | <ul style="list-style-type: none"> <li>Regeneration methods that combine removal of individual trees and groups of canopy trees with retention of a high proportion of mature trees in the stand (single-tree and group selection [0.1- to 0.5-acre openings], irregular shelterwoods, variable-density thinning)</li> <li>Under burning in fire-dependent ecosystems<sup>1</sup></li> </ul> |
| <b>Abundant downed deadwood in various sizes and stages of decay</b> | <ul style="list-style-type: none"> <li>Habitat for deadwood-dependent species</li> <li>Microsites for regeneration of small-seeded tree species</li> <li>Soil stabilization, nutrient cycling, and moisture retention</li> <li>Carbon storage</li> <li>Water/moisture storage</li> </ul>                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Regeneration safe site for tree species during drought</li> <li>Water storage and reduction in run-off during extreme events</li> <li>Microrefugia for moisture-sensitive taxa, such as amphibians, during drought</li> </ul>                                            | <ul style="list-style-type: none"> <li>Felling and leaving larger-diameter trees, particularly through culling</li> <li>Legacy tree designation to provide future deadwood inputs</li> <li>Limiting or refraining from salvaging trees after disturbance</li> </ul>                                                                                                                          |
| <b>Multiple canopy layers</b>                                        | <ul style="list-style-type: none"> <li>Foraging and nesting habitat for breeding birds</li> <li>Habitat for epiphytic lichens</li> <li>Interception and storage of precipitation</li> <li>Habitat for arboreal mammal species</li> <li>Stable microclimates: moderate temperature swings (thermal buffering), reduce wind speeds, maintain higher minimum temps, and provide greater efficiency in absorbing/dissipating incoming solar energy</li> </ul> | <ul style="list-style-type: none"> <li>Reduced vulnerability to disturbance (heterogeneity in wind risk and host sizes for insect pests)</li> <li>Resilience to canopy disturbance (presence of advance regeneration)</li> <li>Water storage via interception to buffer extreme precipitation events</li> </ul> | <ul style="list-style-type: none"> <li>Regeneration methods that promote and maintain multi-age conditions (selection and irregular shelterwood methods)</li> <li>Protection of advance regeneration during harvesting</li> </ul>                                                                                                                                                            |

<sup>1</sup> Fire-dependent ecosystems are those in which fire is an important driver of forest conditions and processes, including the establishment and reproduction of certain plant species. Although fire is a comparatively rare disturbance in New England and New York forests relative to other parts of the globe, several of our ecosystems, namely pitch pine barrens and oak woodlands, were historically shaped by natural fires and Indigenous burning practices. As such, restoration of old-growth conditions in these areas may include the use of prescribed fire to restore barren and woodland conditions and encourage the recruitment of certain plant species, including oak and pine.

| Old-Growth Attribute                                                     | Ecological Function                                                                                                                                                                                                                                | Adaptation Mechanism                                                                                                                                                                                                                                                  | Management Strategies                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Large-diameter standing dead trees (snags)</b></p>                 | <ul style="list-style-type: none"> <li>Foraging and nesting habitat for breeding birds</li> <li>Habitat for deadwood-dependent organisms</li> <li>Roosting sites for bats</li> <li>Carbon storage</li> <li>Future source of downed logs</li> </ul> | <ul style="list-style-type: none"> <li>Microrefugia for moisture-sensitive taxa during drought</li> </ul>                                                                                                                                                             | <ul style="list-style-type: none"> <li>Legacy tree designation to allow for natural snag development, with priority given to existing cavity trees</li> <li>Girdling of large-diameter trees</li> <li>Prescribed fire in fire-dependent ecosystems</li> </ul>                                                                                                        |
| <p><b>Regeneration</b></p>                                               | <ul style="list-style-type: none"> <li>Microhabitats (light, temperature, moisture) supporting understory plant and regeneration development</li> <li>Hiding and nesting cover for bird species</li> </ul>                                         | <ul style="list-style-type: none"> <li>Reduced vulnerability to disturbance (spatial variability in wind risk, fuels, drought stress)</li> <li>Multiple recovery and developmental pathways (regeneration in gaps, propagules from surviving mature trees)</li> </ul> | <ul style="list-style-type: none"> <li>Regeneration methods that promote and maintain multi-age conditions (selection and irregular shelterwood methods)</li> <li>Protection of advance regeneration during harvesting</li> <li>Control of competing vegetation (e.g., invasive plants and beech thickets)</li> <li>Control of deer and moose populations</li> </ul> |
| <p><b>Plant communities (understory plants, mosses, and lichens)</b></p> | <ul style="list-style-type: none"> <li>Hiding and nesting cover for bird species</li> <li>Food and energy sources for insects, including late-seral pollinators</li> <li>Retention and cycling of nutrients</li> </ul>                             | <ul style="list-style-type: none"> <li>Source populations for post-disturbance recovery</li> </ul>                                                                                                                                                                    | <ul style="list-style-type: none"> <li>Designation of reserve “patches” within stands where no harvesting occurs</li> <li>Retention of canopy trees supporting an abundance of mosses and lichens</li> </ul>                                                                                                                                                         |

### Atypical Old Growth

We largely associate old-growth forests with forest types and locations on the landscape where large and old trees and closed-canopy forest conditions can develop. Nevertheless, there are many other places, such as ridgetops and wetlands, where old-growth forests once existed. These areas are less likely to be actively managed to restore old-growth characteristics, but their protection through a passive approach is equally important to ensure that the full suite of old-growth forest communities once common across the region are restored and maintained. Examples of these “atypical” old-growth forests include dwarf pitch pine woodlands, cedar bluffs, black gum swamps, and black spruce bogs. In addition to these atypical old-growth communities, other old-growth ecosystems are better characterized as woodlands or barrens, which have far more open forest conditions than most of the forests predominating in our region. These lower-density conditions are often associated with site conditions (e.g., dry, nutrient-poor soils) and disturbance regimes (frequent low severity fires) that prevent the formation of dense forests. Given that natural fires rarely occur in our climate, burning by Indigenous communities for culturally significant wildlife and plant species was an important factor locally in maintaining many of these ecosystems, including pitch pine barrens and oak woodlands. As such, restoring old-growth conditions in places where these communities once predominated would benefit from an understanding of traditional cultural practices to guide the application of prescribed fire and other management techniques.





# RESTORATION OF OLD-GROWTH CHARACTERISTICS

Old-growth characteristics can be restored to your woods through either passive or active management. Although there are landscape characteristics that may make one strategy more effective than the other, these approaches are highly complementary, and both are necessary across the landscape. In addition, the active management approach offers a gradient of strategies that can be used based on the landowner’s interest in increasing the “old-growthness” of their forests while meeting other landowner goals (e.g., wildlife) and societal needs (e.g., locally produced wood products).

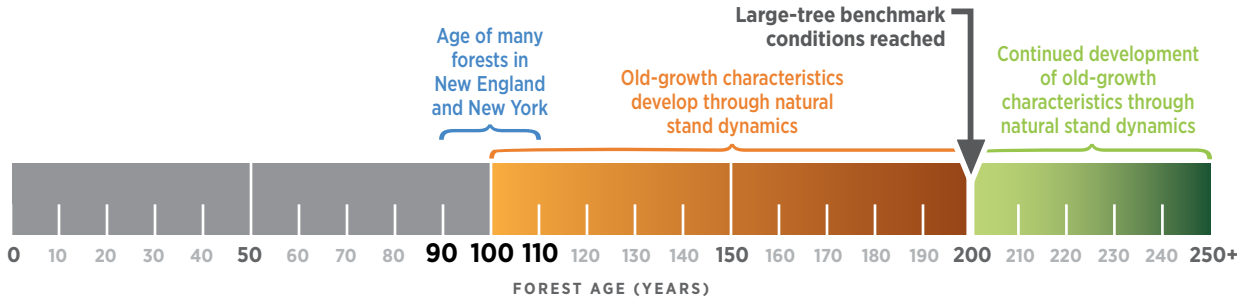
## PASSIVE MANAGEMENT

This approach involves letting nature take its course and waiting for forest development and natural disturbances to create old-growth characteristics without any direct human intervention. Designating an area of your land as a reserve without active forest management does not mean old-growth characteristics will appear in those places overnight. Developing these conditions with a passive approach will often take over a century (see figure below) based on the current age of most forests in New

England and New York and is influenced by the fertility of the site on which it is growing, past agricultural impacts on the soil from tilling and grazing, and the amount of natural disturbance to which the forest is exposed. In addition, the current condition of the forest will strongly influence the likelihood and rate of old-growth characteristics developing, as current forest conditions—such as the presence of dense forest plantations, abundant invasive plants, high deer densities, or beech bark disease—may inhibit the development of key old-growth characteristics (large living and dead trees, multiple canopy layers) and inhibit or reduce biodiversity, carbon storage and sequestration, and resilience to climate change. As such, achieving old growth via passive management isn’t suited for every forest condition currently on the landscape.

As with old-growth systems, the key drivers creating old-growth characteristics with a passive approach are disturbance events, such as windstorms, ice storms and snowstorms, and insect and disease outbreaks. These events strongly influence forest structure and composition by creating gaps in the forest canopy, standing dead trees, pit-and-mound topography from blown-over trees, and downed logs on the forest floor. The progression and rate of change in passively managed areas is determined by the type, frequency, and intensity of natural disturbance. Since the most frequent disturbance events affect only single or small groups of trees, a passive approach will tend to favor tree species that are most competitive in shade, such as hemlock, beech, sugar maple, and

Passive Pathway to Old Forests



Adapted from Hagan and Whitman (2004)

## Should I Salvage My Woods?

Developing old-growth characteristics, whether through a hands-off or an active approach, involves leaving dead and dying trees in the woods. After a disturbance such as a windstorm or an insect and pathogen outbreak, landowners are often interested in salvaging trees that have been knocked down or killed. While initially looking “messy,” leaving these trees in the woods is critical to developing old-growth characteristics. In particular, natural disturbances serve as active assistance in the development of old-growth characteristics. These are the very processes and structures that are missing in our woods. With extreme weather events happening more frequently due to climate change and invasive insects—including the emerald ash borer, the spongy moth, the hemlock woolly adelgid, and beech leaf disease—now being found in many parts of the region, it is likely that the opportunity for salvage will only increase in the future. It is important to remember that these disturbances



are generating key deadwood absent from most forests, canopy openings that allow for the establishment of regeneration, and complex young forest conditions necessary for many species of wildlife. As such, limiting salvage operations or deliberately leaving some disturbed areas unharvested during salvage operations will ensure the positive legacy of these events by making sure that key structural conditions are maintained.

red spruce. Because no trees are harvested with this approach, it will produce the most natural appearance and conditions in your woods in the long run (i.e., no cut stumps or skid trails and more deadwood remaining).

The passive approach to the restoration of old-growth characteristics will likely result in the greatest amount of carbon storage. As time goes by, trees get larger, more deadwood is added to the forest, and soils continue to increase as deadwood decomposes. The passive approach is therefore a good strategy for those interested in storing carbon that has already been removed from the atmosphere; however, landowners should recognize that forests dominated by low-vigor trees and invasive species may not accrue these carbon storage benefits at a similar level to natural and healthy stands.

Landowners interact with their land in a variety of ways. The ultimate goal of the passive approach is to let natural forest processes and disturbances develop the missing characteristics over time. Activities that allow these processes to be the primary driver are compatible with a passive approach. Hiking trails, controlling invasive species, removing a tree infested with an invasive insect, and even removing a few cords of wood per year for firewood can all be compatible with the passive approach.

Taking a passive approach to restoring old-growth characteristics will help meet the goals for increasing wildlands across the region. Since the time frame for developing old-growth characteristics is beyond that of a family forest owner, engaging in forest and estate planning is critical to achieving and sustaining old-growth characteristics in your woods.

ACTIVE MANAGEMENT

The second approach to restoring old-growth characteristics involves active management of the forest. Active management falls onto a gradient of intensities that can be tailored to specific goals and forest conditions. Carefully planned forest management provides an opportunity to accelerate the development of old-growth characteristics. An active approach can also be used not only to meet regeneration goals by creating the light conditions

Carefully planned forest management provides an opportunity to accelerate the development of old-growth characteristics.

necessary for species that are most competitive in partial or even full sunlight (e.g., yellow birch, black cherry, white pine, and red oak), restoring aspects of the compositional complexity of old-growth forests, but also to benefit wildlife and increase forest resilience through diverse species composition. In addition, active management can

provide young forest habitat for those species that depend on it, increase a forest’s resilience to such challenges as invasive insects and wind events, and meet important needs for local wood products. Forest management provides an opportunity to mimic the processes historically shaping the diversity and conditions of our forests (i.e., natural disturbances), thus increasing the growth of remaining trees and speeding up the development of old-growth characteristics. Although it may sound

counterintuitive, active management can restore old-growth structural characteristics and associated values and functions faster than the passive approach (see the timeline on page 15), since active management offers the opportunity to purposefully introduce the disturbances that result in a number of the old-growth characteristics.

Many of the forest stewardship practices used for meeting other landowner objectives are also excellent tools for restoring old-growth characteristics; however, it is critical for landowners to match these practices with the types of old-growth characteristics they hope to restore.

Restoring Large Trees, Multiple Canopy Layers, Regeneration, and Diverse Species

As with other management approaches, the tactics used for restoring old-growth conditions will vary based on the forest type and existing conditions, given that a guiding principle for active old-growth restoration is to emulate the natural developmental dynamics for that specific ecosystem through forest management. Nevertheless, a key action likely necessary for most New England and New York forests is enhancing age-class diversity and spatial complexity. This action is meant to address the largely even-aged (i.e., composed of trees all largely the same age due to past land use) and spatially uniform arrangement of trees in most current forests, which is very different from that of the old-growth forests.

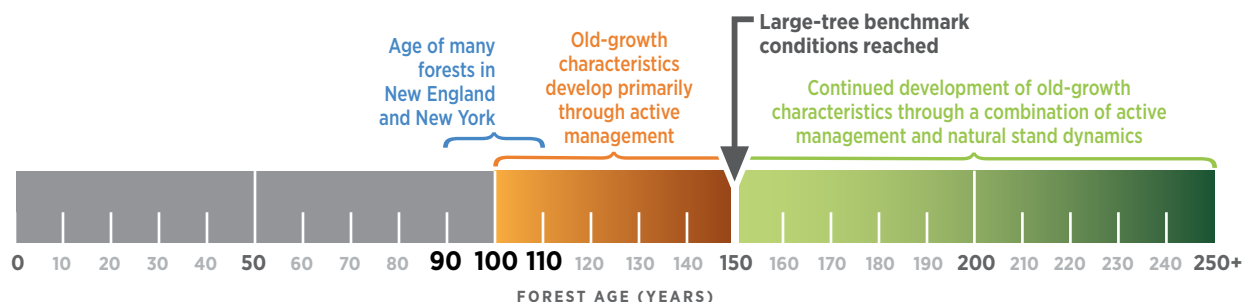
Forest management techniques that create gaps in the canopy can be used to increase large

TABLE 2 Decadal development of large-tree densities in a northern hardwood forest actively managed for old-growth characteristics. Numbers represent percentage of large-tree benchmark densities (lower and upper range) being achieved each decade in a forest receiving 2–3 crown thinnings to accelerate large-tree growth over a 50-year period. Assumed diameter growth of large trees is based on Nyland et al. (1993) and Singer and Lorimer (1997) and were applied to average stand conditions in New England and New York based on USDA Forest Service Forest Inventory and Analysis data. The time needed to reach the large-tree target will depend on stand conditions and site quality.

| Percentage of the large-tree target reached over time through active management (2–3 crown thinnings) starting from current forest conditions |                           |          |          |          |          |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------|----------|----------|----------|----------|
| Density of large trees (DBH >20")                                                                                                             | Average Current Condition | 10 years | 20 years | 30 years | 40 years | 50 years |
| 12 trees per acre (lower bound of large trees)                                                                                                | 8%                        | 15%      | 45%      | 75%      | 105%     | 165%     |
| 20 trees per acre (upper bound of large trees)                                                                                                | 5%                        | 10%      | 25%      | 45%      | 65%      | 100%     |



## Active Pathway to Old Forests



trees, create multiple canopy layers, and establish regeneration. In particular, implementing regeneration harvests that create the growing space necessary for establishing seedlings and allowing the development of advance regeneration into the main canopy while retaining a large proportion of the forest in mature trees will help restore these old-growth characteristics. Examples of these silvicultural systems include single-tree and group selection, irregular shelterwood, and variable density thinning.

These regeneration methods can be designed to create canopy gaps that emulate those frequently created by natural disturbances (0.1–0.5 acres), although larger openings (1–3 acres) with legacy tree retention (see next section) can also be created to emulate historic landscape scale disturbances, like microbursts. Openings of this size can favor shade mid-tolerant (e.g., oak and pine) and shade-intolerant (e.g., black cherry, tulip poplar, and bigtooth aspen) species, which are most competitive with higher levels of light. Creating this range of openings in the canopy is critical in accommodating common old-growth canopy species, such as yellow birch and white pine, which require greater levels of light than do shade-tolerant species. Although much of the focus of restoring old-growth characteristics is placed on the structural attributes found in old growth, restoration strategies should also consider the future species composition of the forest as well. Regenerating diverse species can not only help achieve landowner goals but also increase forest resilience at the landscape level by diversifying the types of species found across the forest. This diversity makes forests less vulnerable to such

challenges as invasive insects and diseases, which focus on particular species, and increases the variety of functional traits present (e.g., species drought and heat tolerance), providing multiple ways for the forest to respond to future climate change.

When implementing this type of harvest, allocate 10 to 20 percent of the area in your forest to openings to establish regeneration. This number of openings emulates average natural disturbance rates if applied every ten to twenty years and provides the opportunity for future entries to create a mosaic of old-forest conditions over time. Similarly, skipping a comparable area in your forest (10%–20%) and designating them as “patch reserves”—a group of legacy trees in your woods dedicated to developing old-growth structure—will contribute to forest-wide goals of restoring the heterogeneity of tree densities found in old growth.

### Restoring Large and Old Trees and Deadwood

A key element of active management for old growth is identifying and retaining trees to live out their natural life span in the woods. These trees, often referred to as “legacy” trees, are in the main canopy and are left to serve as future sources of old-growth structure. Unlike trees that are left following traditional timber harvests to grow larger and be harvested in the future, legacy trees are never removed from the woods. Instead, these trees are left to grow larger and die—providing standing dead trees for habitat—and eventually fall over, providing different habitat value as a large downed log on the forest floor. Due to their age, legacy trees can







**Legacy tree:**

a tree purposefully left in the forest to grow large, grow old, and die, creating old-growth characteristics often lacking, such as large living trees and deadwood.

**Patch reserve:**

a group of legacy trees. Also referred to as a “skip,” since active forest management practices are skipped in that part of the forest.

also have greater levels of genetic variation than younger trees in a second growth forest owing to genetic changes in vegetative cells that accumulate as a tree ages, which is important for our forests as they face an increasing number of challenges in the future.

Depending on your objectives, individual legacy trees can be dispersed throughout your land or retained in small groups as patch reserves. In the selection of legacy trees and patch reserve locations, preference should be given to trees in your woods that already contain important habitat features, such as cavities and dens, or patches of your woods containing ecologically sensitive features, like a well-developed population of forest herbs or highly decayed deadwood. Likewise, reserving large canopy trees with wide crowns will allow for faster development of large-diameter trees on your property. Finally, selecting long-lived species for legacy trees, such as sugar maple, red spruce, yellow birch, red and white oak, white cedar, and white pine, can ensure that these old-growth characteristics are present on your land for future generations.

The number of legacy trees left will depend on your landowner goals. If old-growth restoration is your primary objective, then leaving 25 to 50 percent of your canopy trees as legacies and patch reserves will ensure that an old-growth structure will develop over time. If fewer trees are left, it will take longer for the structure to develop. However, leaving even just a few legacy trees per acre can

provide old-growth characteristics missing from most woodlots.

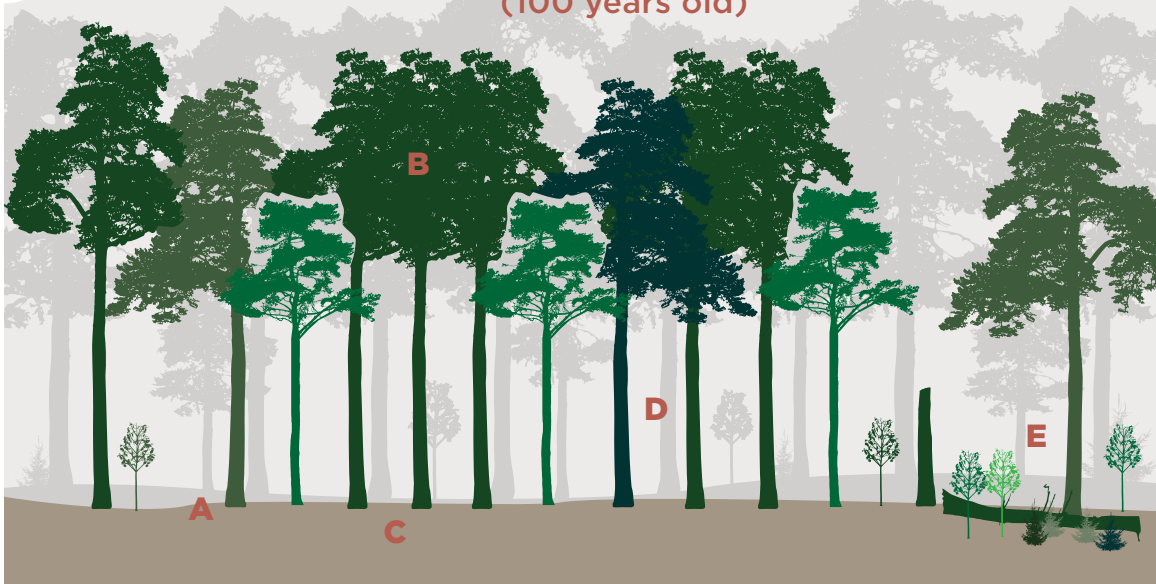
While the retention of legacy trees provides for restoration of the large-tree structures currently lacking in most forests, there are opportunities to accelerate the development of these structures on your land through active forest management techniques. Specifically, the time frame it takes to restore large living trees can be shortened by removing competing trees directly adjacent to the largest vigorous trees. This increases resources available for their growth and can shorten the time necessary to reach large diameters (>20" DBH; see Table 2, page 14) by several decades. Similarly, large standing dead trees can be created through girdling large-size trees, and the number and volume of downed logs can be enhanced by felling and leaving these trees on the ground. These deadwood-creation activities can complement traditional forest management by concentrating on canopy trees not desirable for commercial purposes (often termed “unacceptable growing stock”), thus improving the growth of residual trees to meet complementary landowner objectives. Focusing these large-tree management activities between openings and patch reserves (also called “skips”) will enhance the heterogeneity in forest structural conditions found on your land and provide a distributed source of future large deadwood. Table 3 (page 20) provides information on potential targets to guide these and other active restoration practices on your land.



Example restoration of old-growth characteristics using the active management approach

1

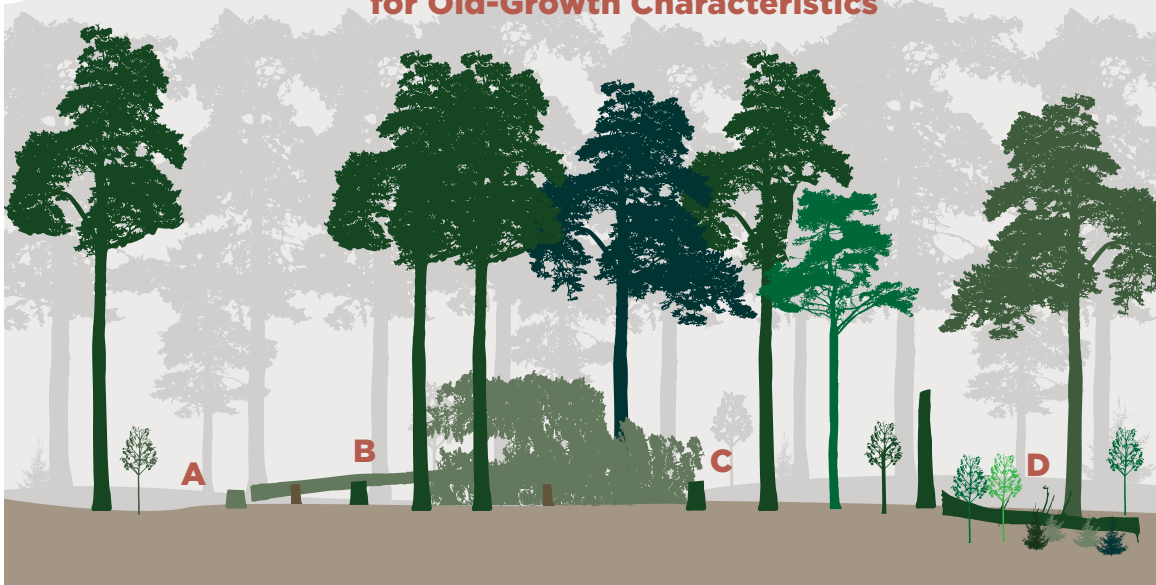
Second Growth Forest  
(100 years old)



- A. Very few large standing or downed deadwood.
- B. Uniform main canopy without multiple canopy layers. Little variation in tree size and density.
- C. Very little regeneration.
- D. Few large-diameter trees.
- E. The development of some old-growth characteristics (deadwood, multiple canopy layers, regeneration, increased variation in tree size and density) from natural disturbance.

2

Second Growth Forest with Active Management  
for Old-Growth Characteristics



- A. Creation of a ¼–½-acre gap to diversify the canopy layers, establish regeneration, and increase variation in tree size and density.
- B. Intentionally leaving a large tree on the ground to increase downed deadwood.
- C. Thin trees to increase their growth rates, speeding up the development of large-diameter trees.
- D. Creation of a patch reserve in an area with existing old-growth characteristics to serve as a foundation on which to build.

3

### 15 Years after Active Management for Old-Growth Characteristics



A. Gap is filled with saplings of diverse species from the increased light availability, widening the variation in tree size, density, and composition.

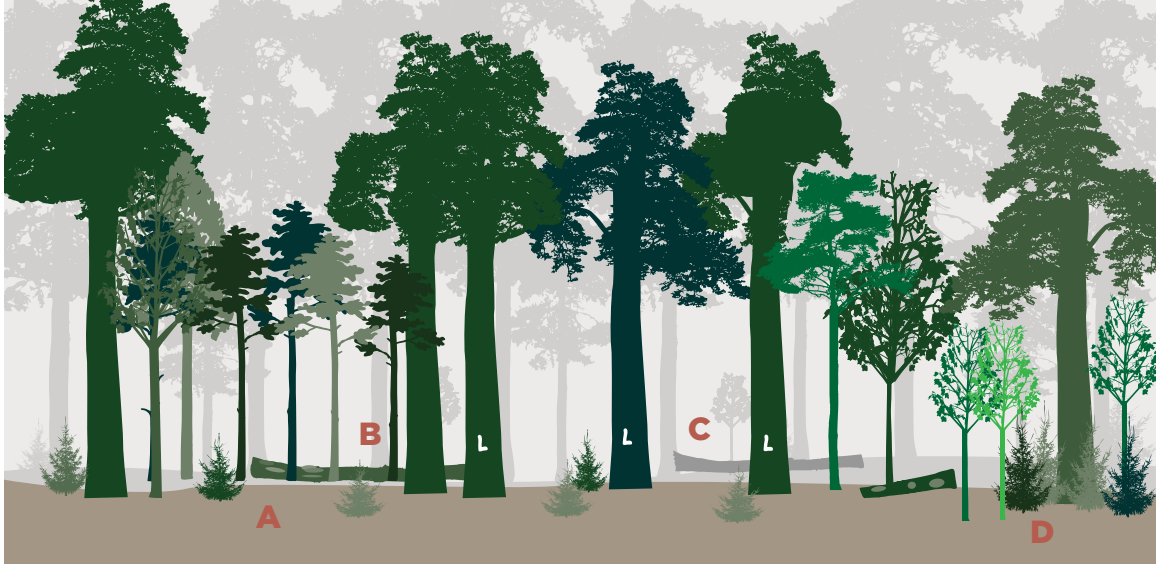
B. Downed deadwood has begun to decompose.

C. Residual trees, now marked with an "L" (legacy tree) to show that they will remain in the forest to live out their natural life span, have increased in size from the thinning.

D. The patch reserve continues to develop.

4

### 30 Years after Active Management for Old-Growth Characteristics



A. Young trees continue to grow.

B. Downed deadwood continues to decompose.

C. Residual trees continue to increase in size from the thinning.

D. Trees within the patch reserve continue to develop, contributing to the variation in tree size and density across the stand. The snag falls and now serves as downed deadwood.

**TABLE 3** Forest structural benchmarks for restoring stand structural conditions that approach those found in common old-growth forest types in New England and New York. Targets are based on values in studies of existing old-growth northern hardwood, northern hardwood–spruce mixed woods, oak–central hardwood, oak–pine–hemlock, and spruce–fir stands. Values are meant to represent long-term goals, as few contemporary forests contain these conditions. If engaged in active old-growth restoration, these targets should be considered in conjunction with regeneration harvests (selection and irregular shelterwood methods, variable density thinning) that introduce spatial heterogeneity in tree densities across a stand and restore aspects of structural and compositional complexity. Subscripts “p” and “c” indicate benchmark values for downed deadwood structural targets for ownerships on which restoration of old-growth structural characteristics is either a primary or a complementary objective. In the latter case, other objectives (e.g., harvest of trees for local wood) may limit the total number of large trees that can be left on-site. Values for downed wood targets assume that a low level of downed deadwood is currently present on-site. Snag recommendations assume that large-diameter (>20" DBH) legacy trees are used to meet long-term snag/cavity tree basal area targets; however, old-growth forests generally contain a wider range of snag diameters.

| Old-Growth Attribute                                                            | Benchmark                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Management Approach                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Large live trees                                                                | <p><b>Northern hardwood (NHW):</b><br/>12–20 trees &gt;20" DBH per acre</p> <p><b>Northern hardwood–spruce mixed woods (MW):</b><br/>11–21 trees &gt;20" DBH per acre</p> <p><b>Oak–central hardwood (CHW):</b><br/>4–18 trees &gt;20" DBH per acre</p> <p><b>Oak–pine–hemlock (OPH):</b> 3–35 trees &gt;20" DBH per acre</p> <p><b>Spruce–fir (SF):</b> 10–35 trees &gt;20" DBH per acre</p>                                                                                                                                                                                                                                                                                                                                                                               | Sizes can be attained through passive (i.e., letting trees grow) or active (i.e., crown thinning around legacy trees) approaches. For active approaches, applying crown thinning around 40–60 trees per acre provides the density of large trees to account for natural mortality and supplies candidate trees for snag and downed log creation and future commercial removals.                                                                                                                                                                    |
| Abundant downed logs in various stages of decay and across a range of diameters | <p><b>NHW<sub>p</sub>:</b> 7–9 cords (cds)/acre (16–20 trees 20" DBH per acre)</p> <p><b>NHW<sub>c</sub>:</b> 3–5 cds/acre (8–10 trees 20" DBH per acre)</p> <p><b>MW<sub>p</sub>:</b> 7–11 cds/acre (11–16 trees 20" DBH per acre)</p> <p><b>MW<sub>c</sub>:</b> 4–6 cds/acre (6–9 trees 20" DBH per acre)</p> <p><b>CHW<sub>p</sub>:</b> 3–8 cds/acre (5–14 trees 20" DBH per acre)</p> <p><b>CHW<sub>c</sub>:</b> 2–4 cds/acre (3–7 trees 20" DBH per acre)</p> <p><b>OPH<sub>p</sub>:</b> 7–15 cds/acre (9–20 trees 20" DBH per acre)</p> <p><b>OPH<sub>c</sub>:</b> 4–9 cds/acre (5–12 trees 20" DBH per acre)</p> <p><b>SF<sub>p</sub>:</b> 8–12 cds/acre (11–17 trees 20" DBH per acre)</p> <p><b>SF<sub>c</sub>:</b> 3–7 cds/acre (8–10 trees 20" DBH per acre)</p> | Reach target through natural mortality of legacy trees and snag falls. If stand is far below target, consider increasing the number by felling trees >20" DBH and leaving them on the ground. Felled trees can concentrate on unacceptable growing stock (UGS). Typical large-diameter snag fall rates: ~40%–60% of northern hardwood, oak, pine, hemlock, and spruce snags fall during the first decade after tree death. Snag fall rates may be higher for snags that have been created through girdling, as well as for smaller-diameter stems. |
| Presence of standing dead trees                                                 | <p><b>NHW:</b> 15–25 ft<sup>2</sup>/acre (8–12 trees &gt;20" DBH per acre)</p> <p><b>MW:</b> 17–43 ft<sup>2</sup>/acre (8–12 trees &gt;20" DBH per acre)</p> <p><b>CHW:</b> 8–15 ft<sup>2</sup>/acre (4–7 trees &gt;20" DBH per acre)</p> <p><b>OPH:</b> 4–55 ft<sup>2</sup>/acre (2–16 trees &gt;20" DBH per acre)</p> <p><b>SF:</b> 15–45 ft<sup>2</sup>/acre (7–12 trees &gt;20" DBH per acre)</p>                                                                                                                                                                                                                                                                                                                                                                       | Target can be met through natural mortality of legacy trees. If stand is far below target, consider girdling trees >20" DBH. Girdled trees can concentrate on UGS.                                                                                                                                                                                                                                                                                                                                                                                 |



# SITING OLD-GROWTH RESTORATION AREAS: WHERE AND WHEN

## Where

You may choose to implement old-growth management and restoration, whether passive or active, in all of your woods or only a portion. Restoring old-growth characteristics to a variety of sites with soils ranging from wet to dry will help provide a diversity of old-growth characteristics and conditions. When considering where on your land to develop old-growth characteristics, it is most effective to identify and enhance old-growth structural characteristics already present

**When considering where on your land to develop old-growth structure, it is most effective to identify and enhance old-growth structural characteristics already present in your woods.**

in your woods. These areas might include large amounts of downed logs due to a windstorm, or a group of large trees containing woodpecker cavities. Focusing the passive approach on areas of high ecological or cultural value (e.g., cedar swamps, ridgetops, vernal pools, spring ephemerals, and medicinal plants) provides the added benefit of protecting these important resources. Identifying and documenting areas of your forest with existing old-growth characteristics and those with special ecological or cultural

value is a key first step of both active and passive strategies. Establishing a patch reserve around existing old-growth characteristics will enhance their value as old-growth habitat by providing contiguous forest dedicated to developing additional old-growth features. In addition, designating patch

reserves in an area with high environmental variation (e.g., topography, moisture, and soil productivity) will help restore the natural variation in forest types once found across the landscape.

Another consideration in siting your old-growth efforts is directing them to areas of your land in which management for old-growth features will develop fastest. These areas would include those of the highest site quality in which the restoration of structures, such as large living and dead trees, would occur most rapidly. Site quality is a way to describe the fertility of a site and is determined by the amount of available water and nutrients for plant growth. High-productivity sites will grow big trees faster than will low-productivity sites. Old-growth structure (big trees, large standing dead trees, and large downed logs) will develop faster on high-productivity sites. If you are a landowner, work with a professional forester to understand your options based on the ecological conditions across your land and to balance your objectives. To find a qualified forester working in your town, see the “Additional Resources” section.

While leaving a scattering of legacy trees across your forest will certainly contribute to the restoration of old-growth characteristics, the larger the area dedicated to either the passive or the active approach (or both!), the better. A minimum area of approximately ten acres in landscapes that are mostly forested is recommended, as an area of this size will provide enough forest for the development of environmental conditions and characteristics that are different from the forests around it, which are stewarded in more traditional ways. However, the minimum size is greatly affected by the landscape within which the forest lies. The more isolated a property is within a non-forest matrix, the larger the area should be.

## When

Certainly, there is a regional and global urgency to increase the amount of forests with old-growth characteristics as quickly as possible given their biodiverse value, potential as natural climate solutions, and other important functions; however, not every area on your land or in a region is suitable for immediate action. The timing for when you decide to apply old-growth restoration treatments will depend on the condition of your forest as well as the overall timeline for your stewardship.

### Forest Condition

Older forests that have had time to grow larger trees and are more developmentally advanced due to decades of disturbances already contain some old-growth characteristics. Such forests are excellent candidates for implementing both passive and active strategies, as they will likely serve to speed up the restoration of the range of complexity associated with old-growth forests. Depending on your ownership, this may be all of your forest or only certain areas due to its past land-use history. If you own multiple parcels, identifying areas within your ownership that are at this point in their development will help you identify candidate locations for the active management approach.

### Timing of Landowner Decisions

Forest management decisions aren't always

triggered by what's going on in the woods. Often they are triggered by decisions a family forest owner needs to make about their land or a need or an opportunity in a community or organization. Therefore, when circumstances have triggered a decision about the way in which your forest is going to be stewarded—planning a timber harvest, developing a forest management plan—it is a good time to consider the ways in which restoring old-growth characteristics may contribute to your goals. Since developing these characteristics takes decades, family forest owners should pair these conversations with those about the future ownership and use of the land. Formal conservation-based estate planning to ensure that your land remains forested after you are gone provides the opportunity for future old-growth restoration treatments in those areas. See the “Additional Resources” section to contact a local land trust.

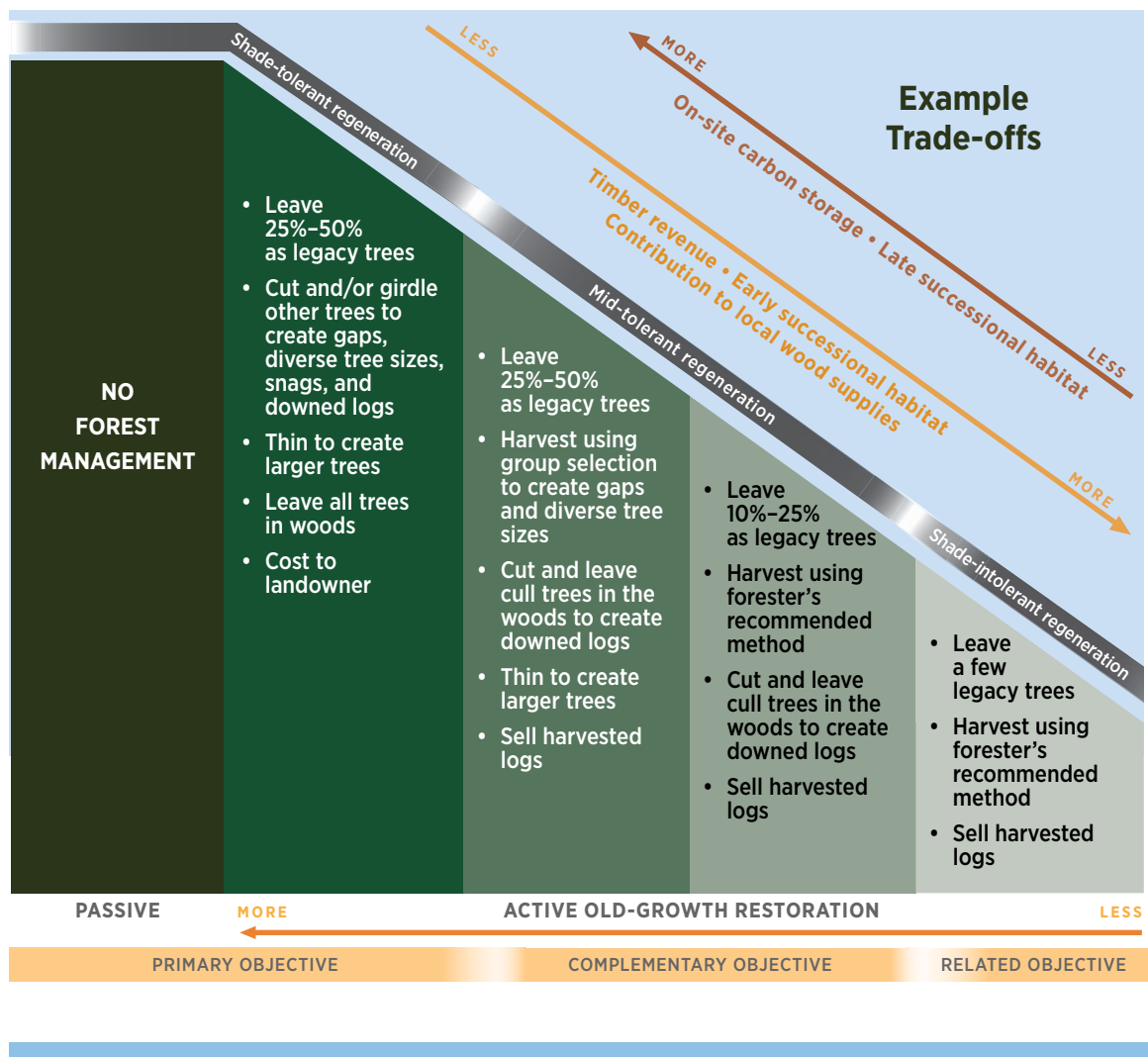
# GRADIENT OF OLD-GROWTH RESTORATION PRACTICES

There is no one specific “old-growth condition” to aim for as an objective and therefore no one way to create it. Instead, it is more valuable to consider increasing the amount of old-growth characteristics in your woods in a way that matches your objectives. While applying the entire set of old-growth restoration practices to your property may be the quickest and most effective way to restore old-growthness back into your forest, this approach may interfere with other management goals, such as creation of early successional habitat and production of sustainable and renewable forest products. It is important to recognize that a gradient of old-growth restoration practices is available for you to apply to your land. This gradient ranges from implementing



a single practice, such as retaining a few legacy trees or felling low-quality canopy trees, to employing combinations of practices. Choosing the level of restoration intensity that is consistent with your other management goals is critical. If you are only interested in applying a single practice, the designation of legacy trees on your property will provide for the greatest number of old-growth characteristics (e.g., large old trees, future snags, and logs).

# Gradient of old-growth restoration strategies



The gradient of restoration treatments can also include a one-time active management approach to “flip the system” followed by a passive approach. Some forests may benefit from this onetime “set it and forget it” active approach to move the forest toward a successional trajectory that will enable natural processes to take over. For example, a plantation of non-native species could have a regeneration harvest to initiate a stand of native species before a passive approach is taken, or a stand of diseased beech with a beech understory could be regenerated to diversify the species composition and allow for the establishment of

vigorous trees that will better meet the structural old-growth characteristics.

It is also not necessary to choose one approach for your whole property or, if you own multiple properties, all your properties. A mixed approach can be a great way to meet your overall personal or organizational goals—for example, taking a passive approach in one stand of your property and an active approach in others. At the landscape level, we need both types of strategies to meet our societal goals. Therefore, whichever strategy or combination of strategies you choose will contribute in meaningful ways.





### Restoring Old Growth within a Current Use Program

Current use tax programs recognize the many benefits that family forest owners provide to the public by reducing property taxes in exchange for a commitment to keep their land in its “current forest use” and, in many cases, to manage the land according to a state-approved forest management plan. Because restoring old-growth characteristics can include a mix of active and passive approaches, there may be opportunities for these management strategies to be compatible with the current use program in your state. For more information about the current use program in your state and opportunities to incorporate strategies to restore old-growth characteristics, see the “Additional Resources” section to find contact information for your local state service or county forester.

# IMPORTANCE OF A LANDSCAPE PERSPECTIVE

Another important consideration in planning for old-growth restoration is how your land fits into the surrounding landscape. Like most management objectives, an excellent way to increase the functioning of the areas containing old-growth restoration treatments is to implement these strategies in landscapes where other landowners, both public and private, are doing similar management. Even if multiple landowners in a landscape each implemented just a small amount of old-growth restoration strategies, it would add up by providing stepping-stones across the landscape for animal and plant species to move. Consider coordinating your management activities with adjacent landowners to increase the size and effectiveness of those areas serving to replicate old-growth conditions on the landscape. If the property lies within a forest matrix, a smaller area dedicated to these strategies can contribute to the landscape, but if the land around your forest has been converted to residential development, then dedicating a larger area to these strategies is recommended.

Though it is natural to focus attention on property-level considerations, since that’s the scale on which most landowners are making decisions, taking a landscape perspective is not only important in regard to restoring old-growth characteristics but critical to the overall resilience of our forests. Natural disturbances don’t start and stop at property boundaries. Landscapes with a diversity of species composition and forest structure will help ensure that our forests can adapt to such challenges as climate change and invasive insects. Because of our land-use history, many landscapes in New England are composed of forests with homogeneous species and structure. Encouraging the restoration of old-growth

**Taking a landscape perspective is not only important in regard to restoring old-growth characteristics but critical to the overall resilience of our forests.**

forest characteristics through the passive or active approach (or both) will help to create diversity at the landscape level that will increase the resilience of our forests.

Ultimately we need both passive and active approaches on the landscape. The passive approach provides ecological benefits that the active approach cannot, such as maximizing carbon storage. Likewise, it's important to acknowledge the importance of areas where forests are managed with a greater emphasis on young forest habitat for species in decline or wood

production to provide local resources to meet our societal demands, instead of looking to other regions or other parts of the world for our wood and other forest product needs. These approaches complement each other across the landscape by providing for landowner goals and heterogeneity while contributing to an increase in old-growth characteristics where this is a goal. Whichever approach(es) meet your needs, keeping your forest in forest use will help provide immense public value and support myriad plants and animals, especially in the face of global change.

### Example landscape-level implementation of passive and active strategies to restore old-growth characteristics



Each ownership and both passive and active restoration strategies play an important role in helping to achieve a critical mass of old-growth characteristics across the landscape. The map illustrates an example of how both passive and active approaches can be applied across a mixed-ownership landscape. These approaches should be viewed as complementary, restoring important missing elements and serving as stepping-stones for species to move and migrate. Approximately 12% of the area has been designated as passive management, consistent with regional visions for wildland conditions.





Using conservation-based estate planning tools such as conservation easements is an excellent way to ensure that your woods will stay forested long enough to develop the old-growth characteristics you desire.



# LONG-TERM PLANNING

Developing old-growth characteristics takes a commitment to forest continuity and stewardship—that is, leaving your land forested and intentionally leaving more trees in the forest. Even with active management, old-growth characteristics take decades or longer to develop, requiring the need for long-term planning, both within the forest and, in the case of family forest owners, out of the forest through conservation-based estate planning.

## Within the Forest

Within-forest planning is necessary to document your stewardship approach and intention over the long-term. Legacy trees and patch reserves should be clearly designated (e.g., marking legacy trees with an “L” and patch reserve boundaries with paint) and described both on paper (e.g., a map, forest management plan, or baseline documentation report) and in digital form (e.g., photos and GPS locations of legacy trees and areas being managed for old growth). Long-term forest management planning can ensure that future decisions about your woods will not disrupt the development of old-growth structure in areas that have been dedicated to restoring old-growth characteristics.

## Conservation-Based Estate Planning

It is very important to recognize that the development of old-growth structure will depend on what happens to your land once it is passed on. If your forest won't be there in 100 years, what you do now won't matter. Therefore, talking to your heirs and using conservation-based estate planning tools such as conservation easements are excellent ways to ensure that your woods will stay forested long enough to develop the old-growth characteristics you desire. Conservation easements (CEs)—known as conservation restrictions in some states—are permanent legal agreements that allow some land uses (e.g., forest management, agriculture, recreation, and sometimes limited development) and not others (e.g., development or mining). In partnership with a conservation organization, CEs can be tailored to an individual landowner's objectives and can be written to allow the development of old-growth structure both

passively (through a “forever wild” easement) and actively (allowing forest management). There are both public conservation organizations (such as wildlife and natural resource state agencies) as well as private conservation organizations (such as land trusts) that work with landowners on the permanent conservation of their land. Some conservation organizations focus more heavily on passive strategies and others on active approaches, but many do both. Finding a conservation organization or forester that shares your goals and vision for the land is critical. For more information on conservation tools or to find a land trust working in your town, refer to the “Additional Resources” section at the end of this publication. Talking to other landowners who have permanently conserved their land is a great way to hear from those with firsthand experience.

# GETTING STARTED

## Family Forest Owners

Evaluating how developing old-growth characteristics fits with your other goals is a great start. Working with a forester to evaluate your land, its landscape context, and your options for developing old-growth characteristics is an excellent way to develop the appropriate management options and move forward. Contacting your local land trust or public conservation agency to find out your land conservation options is another important step. To find a forester or land trust working in your town, look at the “Additional Resources” section at the end of this publication.

## Public and Private Conservation Organizations

Determining where your organization falls on the old-growth restoration gradient will help you determine target percentages for restoration. Identifying and documenting areas of your forest with existing old-growth characteristics and those with special ecological and cultural value will help you identify specific area(s) in your forest to focus on and build off of to reach your overall target percentages. Decide the approach(es)—active or passive or both—that best meet your organization's goals and fit the conditions of your forest and its landscape context. If using an active approach, choose regeneration harvests that will meet your structural and species composition goals.



## CONCLUSIONS

- Old-growth forests were the predominant natural forest condition that prevailed for thousands of years before extensive human impact, providing many key cultural, spiritual, and ecological values, including habitat for native biodiversity and ecosystem services like carbon storage and water filtration.
- Old-growth forests are increasingly rare in the region.
- Management strategies exist for restoring many of the important forest conditions found in old-growth forests. These strategies can involve either passive or active management approaches.





**Developing old-growth characteristics takes a commitment to forest continuity—that is, leaving your land forested and intentionally leaving more trees in the forest.**

- Old-growth restoration strategies can be implemented in a variety of intensities, stages, and combinations to fit within your overall landowner objectives.
- Even applying a single old-growth restoration treatment, such as designating and maintaining legacy trees, can make a considerable difference in restoring these habitat types to our forested landscapes. The benefits of these practices can be increased in a landscape by working across boundaries with neighbors.
- Beyond biodiversity benefits, the conditions found in forests managed for old growth provide many pathways for adaptation in the face of global change, in addition to forest carbon benefits.
- Long-term forest planning with the help of a forester will allow you to ensure that your landowner objectives are met.
- Conservation-based estate planning tools such as conservation easements (restrictions) are critical for ensuring the successful, enduring restoration of old-growth forest habitat by making sure your woods remain as forest into the future.



# ADDITIONAL RESOURCES

**Restoring Old-Growth Characteristics: publications, webinar recordings, scientific papers**  
[masswoods.org/old-growth](https://masswoods.org/old-growth)

***Forest Carbon: An Essential Natural Solution for Climate Change***  
[masswoods.org/carbon](https://masswoods.org/carbon)

***Increasing Forest Resiliency for an Uncertain Future***  
[masswoods.org/resiliency](https://masswoods.org/resiliency)

**Wildlands, Woodlands, Farmlands & Communities**  
[wildlandsandwoodlands.org](https://wildlandsandwoodlands.org)

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## CONNECTICUT

**CT Department of Energy and Environmental Protection (DEEP), Forestry**  
[portal.ct.gov/DEEP/Forestry](https://portal.ct.gov/DEEP/Forestry)

**Service Foresters for Connecticut Landowners**  
[portal.ct.gov/DEEP/Forestry/Landowner-Assistance/Technical-Assistance-and-Service-Forestry-Support-for-CT-Landowners](https://portal.ct.gov/DEEP/Forestry/Landowner-Assistance/Technical-Assistance-and-Service-Forestry-Support-for-CT-Landowners)

**Find a Consulting Forester**  
[portal.ct.gov/DEEP/Forestry/Service-Forestry-in-CT](https://portal.ct.gov/DEEP/Forestry/Service-Forestry-in-CT)

**UConn Extension**  
[ctforestry.uconn.edu](https://ctforestry.uconn.edu)

**Planning the Future of Your Land**  
[ctconservation.org/conserve-land](https://ctconservation.org/conserve-land)

**Find a Land Trust**  
[ctconservation.org/findalandtrust](https://ctconservation.org/findalandtrust)

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## MAINE

**Department of Agriculture, Conservation and Forestry, Maine Forest Service**  
[maine.gov/dacf/mfs](https://maine.gov/dacf/mfs)

**District Foresters for Maine Landowners**  
[maine.gov/dacf/mfs/policy\\_management/district\\_foresters.html](https://maine.gov/dacf/mfs/policy_management/district_foresters.html)

**Woodland Owners Resources Page**  
[maine.gov/dacf/mfs/woodland\\_owners.html](https://maine.gov/dacf/mfs/woodland_owners.html)

**Find a Consulting Forester**  
[maine.gov/dacf/mfs/policy\\_management/selecting\\_a\\_consulting\\_forester.html](https://maine.gov/dacf/mfs/policy_management/selecting_a_consulting_forester.html)

**University of Maine Extension Service**  
[extension.umaine.edu/woodland](https://extension.umaine.edu/woodland)

**Planning the Future of Your Land**  
[forest.umaine.edu/legacy](https://forest.umaine.edu/legacy)

**Find a Land Trust**  
[mltn.org/trusts](https://mltn.org/trusts)



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## MASSACHUSETTS

**UMass Extension, MassWoods**  
[masswoods.org](https://masswoods.org)

**Massachusetts Department of Conservation and Recreation, Bureau of Forest Fire Control and Forestry**  
[mass.gov/orgs/bureau-of-forest-fire-control-and-forestry](https://mass.gov/orgs/bureau-of-forest-fire-control-and-forestry)

**Service Foresters for Massachusetts Landowners**  
[mass.gov/service-details/service-forestry](https://mass.gov/service-details/service-forestry)

**Find a Consulting Forester**  
[masswoods.org/professionals](https://masswoods.org/professionals)

**Planning the Future of Your Land**  
<https://masswoods.org/legacy>

**Find a Land Trust**  
[masswoods.org/professionals](https://masswoods.org/professionals)

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## NEW HAMPSHIRE

**New Hampshire Division of Forests and Lands**  
[nh.gov/nhdfl](http://nh.gov/nhdfl)

**County Foresters for New Hampshire Landowners, UNH Extension**  
[extension.unh.edu/countyforesters](http://extension.unh.edu/countyforesters)

**Find a Consulting Forester**  
[extension.unh.edu/resource/directory-licensed-foresters](http://extension.unh.edu/resource/directory-licensed-foresters)

**UNH Extension Service**  
[extension.unh.edu/natural-resources/forests-trees](http://extension.unh.edu/natural-resources/forests-trees)

**Planning the Future of Your Land**  
[extension.unh.edu/resource/protecting-your-legacy-new-hampshire-landowners-guide-conservation-based-estate-planning](http://extension.unh.edu/resource/protecting-your-legacy-new-hampshire-landowners-guide-conservation-based-estate-planning)

**Find a Land Trust**  
[nhltc.org/find-land-trust](http://nhltc.org/find-land-trust)

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## NEW YORK

**New York Department of Environmental Conservation, Division of Lands and Forests**  
[dec.ny.gov/lands/309.html](http://dec.ny.gov/lands/309.html)

**DEC Stewardship Foresters for New York Landowners**  
[dec.ny.gov/lands/97398.html](http://dec.ny.gov/lands/97398.html)

**Find a Consulting Forester**  
[dec.ny.gov/lands/5230.html](http://dec.ny.gov/lands/5230.html)

**Cornell Extension, ForestConnect**  
[blogs.cornell.edu/ccforestconnect](http://blogs.cornell.edu/ccforestconnect)

**Find a Land Trust**  
[findalandtrust.org](http://findalandtrust.org)



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## RHODE ISLAND

**Rhode Island Department of Environmental Management (DEM), Forest Environment**  
[dem.ri.gov/programs/forestry](http://dem.ri.gov/programs/forestry)

**Service Foresters for Rhode Island Landowners**  
[dem.ri.gov/programs/forestry/stewardship/index.php](http://dem.ri.gov/programs/forestry/stewardship/index.php)

**University of Rhode Island Extension, Rhode Island Woods**  
[rhodeislandwoods.uri.edu](http://rhodeislandwoods.uri.edu)

**Planning the Future of Your Land**  
[web.uri.edu/rhodeislandwoods/legacy](http://web.uri.edu/rhodeislandwoods/legacy)

**Find a Land Trust**  
[rilandtrusts.org/landTrusts.htm](http://rilandtrusts.org/landTrusts.htm)



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## VERMONT

**Vermont Department of Forests, Parks and Recreation**  
[fpr.vermont.gov/forests](http://fpr.vermont.gov/forests)

**County Foresters for Vermont Landowners**  
[fpr.vermont.gov/forest/list-vermont-county-foresters](http://fpr.vermont.gov/forest/list-vermont-county-foresters)

**Find a Consulting Forester**  
[fpr.vermont.gov/forest/managing-your-woodlands/working-professional](http://fpr.vermont.gov/forest/managing-your-woodlands/working-professional)

**University of Vermont Extension, Our Vermont Woods**  
[ourvermontwoods.org](http://ourvermontwoods.org)

**Planning the Future of Your Land**  
[ourvermontwoods.org/legacy](http://ourvermontwoods.org/legacy)

**Find a Land Trust**  
[findalandtrust.org](http://findalandtrust.org)

**Vermont Conservation Design**  
[vtfishandwildlife.com/conserve/vermont-conservation-design](http://vtfishandwildlife.com/conserve/vermont-conservation-design)









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Since old growth is the condition that our forest species evolved with for thousands of years, maintaining old-growth characteristics within our forests restores missing pieces that will help ensure that our forests continue to sustain themselves and the many benefits we depend on.



**Appendix E** – Example Working Forest Conservation Easement and Multi-Resource Management Plan with Provisions to Protect Mature Forest



**CONSERVATION EASEMENT  
GRANTED BY  
RANGELEY LAKES HERITAGE TRUST, INC.  
TO  
FOREST SOCIETY OF MAINE  
ON LAND IN  
STETSONTOWN TOWNSHIP, FRANKLIN COUNTY, MAINE**

This **DEED OF CONSERVATION EASEMENT** is made this \_\_\_ day of \_\_\_\_\_, 2023.

**RANGELEY LAKES HERITAGE TRUST, INC.**, having a mailing address of 2424 Main Street, Rangeley, Maine 04970 (hereinafter referred to as the “Landowner,” which word is intended to include and bind, unless the context clearly indicates otherwise, the above named Landowner, its successors and assigns) for full consideration,

**GRANTS** to

**FOREST SOCIETY OF MAINE**, a nonprofit corporation organized and existing under the laws of the State of Maine, and qualified to hold conservation easements pursuant to Title 33 M.R.S. Sections 476 et seq., as amended, and the Internal Revenue Code of 1986, as amended at Title 26 U.S.C. Section 170(h)(3), with a mailing address of 115 Franklin Street, 3<sup>rd</sup> Floor, Bangor, Maine 04401 (hereinafter referred to as the “Holder,” which word shall, unless the context clearly indicates otherwise, include the Holder’s successors and assigns, with Landowner and Holder sometimes collectively referred to herein as the “Parties”),

**WITH QUITCLAIM COVENANT**, in perpetuity, the following described Conservation Easement over, through, under and across land located in Stetsontown Township, Franklin County, Maine, being the same premises conveyed to Landowner by deed of Bayroot LLC dated on even or near-even date herewith, hereinafter referred to as the “Protected Property”, as more particularly described in Exhibit A and as generally shown on the map incorporated in Exhibit B, each of which is attached hereto and made a part hereof by reference and as shown on the perimeter boundary survey by Plisga & Day Land Surveyors (the “Survey”), which is to be recorded in the Franklin County Registry of Deeds made a part hereof by reference (the “Conservation Easement”).

**RECITALS**

WHEREAS, the approximately 5,096-acre Protected Property is a predominately forested land area that has ecological, economic, and recreational Conservation Values including forests of high quality, productive soils, native wildlife and plant habitat, wetlands, streams, and other water bodies, and unique natural features, as described in Section 1 of this Conservation Easement and in the Baseline Documentation Report; and

WHEREAS, it is the Holder’s mission to conserve Maine’s forestlands to sustain the ecological, economic, cultural, and recreational values of Maine’s woods, including the protection of important natural resources such as lakes, wetlands, rivers and mountains; and

WHEREAS, the Landowner intends to manage the Protected Property to protect wetlands, protect water quality and fisheries habitat, and watershed integrity and to promote diverse wildlife habitats and productive forest growth, along with recreational opportunities for hiking, hunting, snowshoeing, cross-country skiing, and fishing; and

WHEREAS, management of the Protected Property in accordance with Sustainable Forest Management Principles, as defined herein, can foster the development of older and uneven-aged forest stands that enhance the role forests can play to mitigate climate change and improve wildlife habitat; and

WHEREAS, the Protected Property is productive timberland, currently enrolled in the Maine Tree Growth Tax program, and the Landowner may use the Protected Property for sustainably managed Forest Management Activities under the terms and conditions set forth in this Conservation Easement in a manner that is consistent with the protection of the Protected Property's Conservation Values; and

WHEREAS, the Protected Property includes 12.06 miles of tributaries to the Kennebago River including Bear Brook, Wiggle Brook, Sol Brook, Otter Brook, and two unnamed tributaries, all of which are critical thermal refuge, spawning, and rearing habitat for native brook trout; and

WHEREAS, a May 2022 survey conducted by the Maine Department of Inland Fisheries and Wildlife (MDIFW) documented amphibian breeding areas on the Protected Property including Wood Frog, Spotted Salamander and Blue Spotted Salamander, the latter being a species of Special Concern in Maine; and

WHEREAS, the Protected Property directly abuts other large conservation tracts that provide connectivity to well over 100,000 acres of existing conservation lands across the Rangeley Lakes and High Peaks regions of Western Maine; and

WHEREAS, the Protected Property is located on lands in Maine, which is known to have been inhabited by Wabanaki people, including the Maliseet, Mi'kmaq, Passamaquoddy, Penobscot, and Abenaki Nations, since time immemorial according to oral histories, and for at least 13,000 years according to the archaeological record; and

WHEREAS, The Wabanaki adapted to the changing ecosystems, became expert stone and toolmakers, weaving baskets and snowshoes, and creating other cultural items that enabled successful hunting and fishing in support of their mobile lifestyles where people traveled and traded over long distances; and

WHEREAS, the Protected Property is likely to include natural and cultural resources that are of importance to Wabanaki people for continued harvesting for medicinal, craft, and ceremonial uses, and the Protected Property may be used for Wabanaki cultural purposes with Landowner's permission; and

WHEREAS, the Protected Property contains important habitat for a diverse array of wildlife species including moose, bear, fisher, bobcat, and several species of interior forest-dwelling birds; and

WHEREAS, Holder is qualified to hold conservation easements pursuant to 33 M.R.S. § 476(2) B, as amended; and

WHEREAS, this Conservation Easement is created pursuant to the Maine Uniform Conservation Easement Act, 33 M.R.S. §§ 476 *et seq.*, as amended.

NOW THEREFORE, the Parties hereto have established this Conservation Easement affecting the Protected Property consisting of the following terms, conditions, restrictions, and affirmative rights, which shall run with and bind the Protected Property in perpetuity.

The recitals set forth above are incorporated by reference and made a part hereof.

## **PURPOSE**

The purpose of this Conservation Easement is to provide a significant public benefit by protecting in perpetuity the Conservation Values of the Protected Property as defined in Section 1.2. This Conservation Easement is consistent with Title 33 M.R.S. Sections 476 *et seq.*, as amended, and is established exclusively for the following conservation purposes (collectively, the “Purpose”):

1. To perpetuate the Protected Property as a sustainable working forest through the long-term professional management and maintenance of the productive forest resources in accordance with generally accepted sustainability standards, and in consideration of the contribution that forest products make to the economy and communities of the State of Maine, including:
  - a. To provide for the economically and ecologically sustainable production of solid wood, fiber, and other wood products; and
  - b. To maintain or enhance water quality, native fish and wildlife habitat soil productivity, recreational values, and scenic characteristics; and
  - c. To maintain or enhance the ability of forests on the Protected Property to mitigate climate change including the sequestration and storage of carbon.
2. To protect and enhance in perpetuity the Conservation Values as defined in Section 1.2 and to prevent any use of the Protected Property, including conversion to non-forest uses that will significantly impair or interfere with the Conservation Values as they exist on the date of this Conservation Easement and as they may evolve in the future.



## 1. DEFINITIONS.

- 1.1. Baseline or Baseline Documentation Report: Means the baseline documentation report prepared pursuant to Section 2.
- 1.2. Conservation Values: Means each and all of the following values associated with the Protected Property:
  - 1.2.1. Forestland Values: The condition of the Protected Property as a healthy, diverse in age and biology, substantially natural, and sustainably managed forested land area containing high quality, productive and non-eroding soils, and capable of providing a continuing and renewable source of commercial forest products within the natural capability of the land;
  - 1.2.2. Landscape-Scale Connectivity Values: The condition of the Protected Property as a largely unfragmented, diverse, substantially natural, and sustainably managed large forest land area that provides connectivity to other conserved lands within the landscape;
  - 1.2.3. Aquatic Resources and Wetland Values: The Protected Property's diverse wetlands, streams, and other aquatic habitats, including fisheries habitats, their water quality, undeveloped shorelines and riparian areas, and the ecological values of these resources and areas;
  - 1.2.4. Wildlife, Plant, and Natural Community Values: The Protected Property's diverse wildlife, plant, forest, and other terrestrial habitats, including habitats of rare, threatened, and endangered flora and fauna, natural communities, and the ecological values and processes of these resources;
  - 1.2.5. Natural Ecological Values. The condition of the Protected Property as a biologically diverse landscape, substantially natural in character, and available to serve as a site for ongoing scientific research, long-term environmental monitoring, and education;
  - 1.2.6. Recreational Values: The Protected Property's diverse opportunities for Low-intensity Outdoor Recreation consistent with the conduct of Forest Management Activities and protecting the other Conservation Values of the Protected Property; and
  - 1.2.7. Scenic Values. The unique natural forested open space scenic views of the Protected Property from the waters of the Kennebago River, Little Kennebago Lake, and Kennebago Lake and from pedestrian trails located on the Protected Property; and
  - 1.2.8. Other Special Values: The unique historic, cultural, archaeological, geological, scientific, or educational qualities of the Protected Property and the attributes and resources of those qualities.

- 1.3. Forest Management Activities: Means the planting, growing, cultivation, stocking, and cutting of trees and other forest products as allowable by law for sale or exchange, and includes timber cruising, resource evaluation, herbicide, pesticide, and fertilizer application, timber stand improvement, pruning, mechanical and conventional timber harvesting and other forest harvest methods, forest products transportation, natural and artificial regeneration of forest stands, maple sugaring, other similar and associated activities, control and prevention of fire, clearing or restoring of forest cover damaged or destroyed by fire, water, wind, insects, disease or other natural disasters, and the construction, creation, use and maintenance of woods roads, skid trails and haul roads, turnouts, timber landings, culverts, bridges, and crossing of flowing waters, and any other similar activities now in existence or hereafter developed.
- 1.4. Forestry Improvements: Means any and all roads, fences, bridges, gates, culverts, boundary monumentation, directional and ownership signage and similar improvements and utilities required for the conduct of Forest Management Activities, and portable or temporary equipment and structures designed for in-woods processing of forest products and in support of Forestry Improvements. For the purposes of this definition, “temporary” shall mean the structure must be moved or removed within 12 months of installation or a longer time agreed to by the Holder in writing.
- 1.5. Forest Management Plan or FMP: Means the plan outlining various activities on the Protected Property prepared pursuant to Section 4.6.3.
- 1.6. Sustainable Forest Management Principles: Means the forest management principles defined in Section 4.6.2.
- 1.7. Sustainable Harvest Level: Means a numerical value (volume) indicating the allowable harvest level for the period of the Forest Management Plan. This shall be developed by calculating a projection of timber growth and harvest, by species group, over the period of the Forest Management Plan, and at least twenty years beyond the term of the Forest Management Plan, based upon current scientific methods to demonstrate that the Protected Property will be managed to ensure a continuing renewable and long-term source of forest products is available and maintain the stocking level over the period of the Forest Management Plan.
- 1.8. Cord: Means a unit of measure of wood products 4 feet wide, 4 feet high, and 8 feet long, or its equivalent, containing 128 cubic feet when the wood is ranked and well stowed. Any voids that will accommodate a stick, log or bolt of average dimensions to those in the pile shall be deducted from the measured volume. The “Conversion Table for Equivalent Cords/Weights for various Maine Commercial Species” included in the Annual Stumpage Report published by the Maine Forest Service shall be used to convert the most widely used scaled timber volume to cords. An appropriate conversion factor for timber scaled by some other unit of measurement not provided in this definition must be approved by Holder.

- 1.9. Low-intensity Outdoor Recreation: Means non-motorized outdoor, nature-based recreational activities including, by way of example and without limitation, hiking, hunting, fishing, trapping, picnicking, nature observation, wild crop harvesting, wildlife study and photography, horseback riding, cross country skiing, bicycling, snowshoeing, camping, and enjoyment of open space.
- 1.10. Parties: Means all signatories to this Conservation Easement and their successors and/or assigns.
- 1.11. Protected Property: Means the land encumbered by this Conservation Easement as described on page 1 of this Conservation Easement and more particularly described in Exhibit A, generally shown on Exhibit B, and shown on the Survey.
- 1.12. Multi-Resource Management Plan or MRMP: Means the plan that outlines various management practices as agreed to by the Parties, as governed by sections 4.6 and 4.7.
- 1.13. Structure: Means any combination of human-made materials on, over, in and/or under the ground or adjacent bodies of water and having a temporary or permanent fixed location. By way of example, an ordinary lawn chair shall not be deemed a structure because it does not have a fixed location; by contrast, a bench installed into the ground shall be deemed a structure because it does have a fixed location. Meanwhile, a picnic table with attached benches is a structure because, even though not typically installed into the ground, it has a temporary fixed location. A structure may be primarily two dimensional, such as a paved road or parking lot, fence or a sign, or three dimensional, such as a building, wall or piping. An unpaved road or trail shall not be considered a structure but shall be considered an improvement and a surface alteration. A structure shall be deemed "minor" so long as it does not have a foundation or a concrete (or similar materials) slab, does not require any excavation or major grading, and is not serviced by electrical power other than portable energy generation systems.

## **2. BASELINE DOCUMENTATION REPORT.**

The Baseline Documentation Report includes documentation, as of the date of this Conservation Easement, of the current knowledge of the Landowner and the Holder of the physical and biological condition of the Protected Property including timber inventory information, its current uses, physical improvements, and the special sites and resources that may require special protection or management, including but not limited to all such information as it relates to documenting and describing the Conservation Values. The purpose of the Baseline Documentation Report is to establish the present condition of the Protected Property as a comparison against which to properly monitor future uses and assure compliance with the terms of this Conservation Easement. The Parties acknowledge and agree that prior to the date of this Conservation Easement, the Holder has prepared and completed the Baseline Documentation Report for the Protected Property, and that the Landowner has acknowledged in writing to the Holder the accuracy of the Baseline Documentation Report.



### **3. LANDOWNER'S RIGHT, TITLE AND INTEREST IN THE PROTECTED PROPERTY.**

The Landowner reserves all right, title and interest in and to the Protected Property, other than those specific rights granted to the Holder and rights otherwise limited or restricted in this Conservation Easement.

### **4. RESTRICTIONS AND LIMITATIONS ON USES OF THE PROTECTED PROPERTY.**

Other than the uses permitted herein, there shall be no residential, commercial, agricultural, farming, ranching, utility, mining, or industrial uses of the Protected Property, specifically:

- 4.1. Extinguishment of Development. All rights to develop, build structures, or use the Protected Property that are prohibited by or inconsistent with this Conservation Easement are extinguished, and as a result of such extinguishment, shall not be available for transfer to any other lands pursuant to a transferable development rights scheme or cluster development arrangement or otherwise. Neither the Protected Property nor any portion thereof shall be included as part of the gross area of any other property not subject to this Conservation Easement for the purposes of determining density, lot coverage, or open space requirements under an otherwise applicable statute, regulation, or ordinance controlling land use and building density. The rights to receive payment or other credits for carbon sequestration or other ecosystem services associated with the use of the Protected Property consistent with this Conservation Easement are not extinguished.
- 4.2. Division. Notwithstanding that the Protected Property may be comprised of more than one tax parcel, for the purposes of this Conservation Easement the Protected Property is merged and managed as an entirety under single ownership. The Protected Property must remain in its current configuration as an entirety under single ownership without division, partition, subdivision, subjection to the Maine Time Share Act (33 M.R.S. c 10-A) or Maine Condominium Act (33 M.R.S. c 31), or other division into parcels or lots that results in, or has the potential to result in, the transfer or conveyance by deed, lease or contract of any portion of the Protected Property, or other legal or de facto creation of lots or parcels in separate ownership or control, except as expressly permitted below, provided that such mortgages, deeds, leases, contracts, or rights of way are expressly subject to the terms of this Conservation Easement:
  - 4.2.1. Mortgage. Any mortgage imposed on the Protected Property provided that such mortgage encumbers the entirety of the Protected Property.
  - 4.2.2. Timber Rights. The sale of any timber rights through timber deeds or stumpage contracts, which shall not exceed ten years in duration.
  - 4.2.3. Rights of Way. The grant of rights of way or other access rights or easements for ingress and egress over and along existing roads as depicted in the Baseline

Documentation Report or as may be created pursuant to Section 4.5. in favor of third parties whose properties abut the Protected Property or for third parties granted timber rights or cultural use pursuant to Sections 4.2.2. or 4.2.4., in all cases without prior written approval from the Holder. Notice is required, as set forth in Section 12, to the Holder, no fewer than thirty (30) days before the granting. No other easements of ingress and egress or utilities shall be created or developed into, on, over, under or across the Protected Property, except with the prior written approval of Holder upon a determination that there will be no harm to the Conservation Values.

4.2.4. Cultural Use. The grant of any lease, permit or easement to permit cultural use of, or access to a portion of the Protected Property for ceremonial use by members of a Wabanaki tribe or limited excavation and harvesting of natural resources for craft, medicinal and ceremonial use by Wabanaki tribal members.

4.2.5. Conveyances to Resolve Boundary Disputes. The Landowner may agree to a boundary line adjustment with prior written approval of the Holder to the extent necessary to resolve bona fide boundary disputes, including conveying portions of the Protected Property to abutters, provided that the total acreage of land protected under this Conservation Easement shall not be materially reduced by such a conveyance and provided that such conveyance does not materially detract from the Conservation Values, and the Holder may release from this Conservation Easement those portions of the Protected Property so conveyed provided that such a release is consistent with the provisions of 33 M.R.S. § 477-A(2)(B) as amended.

4.3. Recreational Use. The Landowner may permit non-motorized public access on and across the Protected Property for Low-intensity Outdoor Recreation insofar as such activities are consistent with the Purposes and terms of this Conservation Easement. Subject to Section 4.3.1, Landowner shall not take actions to prohibit or discourage non-motorized access by the public on or over the Protected Property for Low-intensity Outdoor Recreation.

4.3.1. Rules and Regulations. Landowner may establish reasonable rules and regulations, including rules that pertain to the use of motorized wheelchairs or similar devices to enable access for the disabled, and manage Low-intensity Outdoor Recreation on the Protected Property. Landowner reserves the right to limit, on a temporary basis, non-motorized access by the public to portions of the Protected Property if Landowner, in its reasonable discretion, determines: (a) that such access would damage the Conservation Values to be protected by this Easement; (b) would conflict with active Forest Management Activities; (c) that a hazardous condition exists; or (d) if non-motorized or non-mechanized access would damage roads and trails or other Conservation Values due to seasonal conditions.

The Parties acknowledge that it is not the responsibility of the Holder to manage recreational activities on the Protected Property.

- 4.3.2. Recreational Use Statute. Nothing in this Conservation Easement shall be interpreted as an assumption of responsibility by, or basis for liability on the part of, Landowner for any injury to person or damage to property or loss of life that may be sustained by any person as a result of any entry on or use of the Protected Property. Landowner specifically retains all the protections provided under Maine law to owners of land, including the protections contained in 14 M.R.S. § 159-A.
- 4.3.3. Recreational Use Fees. The Landowner may charge recreational use fees for Low-intensity Outdoor Recreation or for motorized vehicular use in accordance with Section 4.4 to defray the actual cost to the Landowner of building and maintaining recreational and public use infrastructure, and managing recreation use of the Protected Property, provided that such fees do not unreasonably restrict allowed public uses of the Protected Property. The Landowner will provide notice to the Holder of any such fees.
- 4.3.4. Commercial Recreational Uses. Traditional recreational uses by commercial guides, by customers of commercial sporting camps, and by nonprofit camping and educational and scientific institutions are allowed insofar as such activities minimize adverse impacts on Conservation Values and are consistent with the Purpose and terms of this Conservation Easement provided that Landowner not grant exclusive use of the Protected Property to any person or entity for such recreational purposes. Nothing contained herein shall prohibit or limit the Landowner from charging recreational use fees in accordance with Section 4.3.3.
- 4.4. Motorized Vehicle Use. The Landowner may operate, and allow others to operate, motorized vehicles, including ATVs and snowmobiles, on the Protected Property. The Landowner reserves the right to establish rules and to manage recreational activities on the Protected Property, including taking steps to prohibit certain types of vehicles on the Protected Property, and it is the responsibility of the Landowner, not the Holder, to manage recreational activities on the Protected Property. Landowner shall also provide appropriate signage at appropriate locations such as at trail heads and other access points that directs visitors to remain on established trails or to other applicable rules.
- 4.5. Structures and Improvements.
- 4.5.1. Existing Structures. Those structures in existence at the time of this grant and as shown in the Baseline Documentation Report. Existing structures may be maintained or replaced with like structures having the same or similar purpose. All such maintenance or replacement of existing structures shall be conducted so as to minimize adverse impacts on the Conservation Values. Any replacement structures shall be in a substantially similar location, except if other locations are allowed pursuant to Section 4.5.2 or upon the prior written approval of Holder.



- 4.5.2. Additional Structures. No additional structures, improvements, temporary or permanent, may be located, constructed, maintained, repaired, or replaced on, over, or under the Protected Property except as follows:
- 4.5.2.1. Minor Structures. Landowner may develop, construct, maintain, install, replace and repair (i) minor structures related to permitted Low-intensity Outdoor Recreational uses and (ii) minor temporary structures related to outdoor ceremonies and harvesting of resources important for medicine, craft or ceremony by Wabanaki tribal members, provided that all such structures minimize adverse effects on the Conservation Values and are consistent with the Purpose of this Conservation Easement. Such minor structures may include but are not limited to trail markers, steps, water bars, culverts, foot bridges, platforms, railings, small unlighted informational and interpretive signs, registration boxes, wells and springs for fresh water supply, canoe platforms or landings, wildlife observation stations, boundary markers, gates, and barriers to control unauthorized use, prevent access by motor vehicles, or protect fragile areas and areas under active management or study.
- 4.5.2.2. Maintenance of Existing Roads. The Landowner reserves the right to undertake such repairs, maintenance, construction, filling and grading as may be necessary to maintain and improve the existing roads, as identified in the Baseline Documentation Report; provided, however, that such activities shall be conducted so as to minimize adverse impacts on the Conservation Values.
- 4.5.2.3. Forestry Improvements. Landowner may develop, construct, maintain, install, replace and repair at any time and from time to time Forestry Improvements on the Protected Property without Holder approval, including the construction, placement and maintenance of temporary or permanent new roads which shall be located in a manner to minimize adverse impacts on the Conservation Values, and be built and maintained in accordance with all laws and Best Management Practices (BMPs) then adopted or endorsed by the Maine Forest Service or any successor agency at the time of construction and maintenance. Any improvements to existing Forestry Improvements or construction of new Forestry Improvements will minimize adverse impacts on Conservation Values and be subject to applicable Best Management Practices.
- 4.5.2.4. Unused Structures and Improvements. Unless this requirement is waived in writing by the Holder, when structures and improvements are no longer in use, and the lack of use results in a danger to human health or the environment, or conflicts with the Purpose of this Conservation Easement, then the unused structures and improvements shall be removed by Landowner, at the Landowner's cost and expense, and the site shall be allowed to return to a natural condition.
- 4.5.2.5. Recreational Trails, Campsites, and Improvements. The Landowner may construct, use, and maintain recreational trails, including but not limited to pedestrian, snowmobile and ATV trails, primitive campsites, parking areas, emergency helicopter landing sites, and other recreational improvements, provided that such improvements minimize adverse impacts on Conservation Values, are

constructed and maintained in accordance with the Multi-Resource Management Plan (MRMP), and are consistent with the Purpose and terms of this Conservation Easement. Landowner may enter into agreements with organizations, such as snowmobile clubs, to construct and maintain trails and other recreational improvements.

- 4.6. Forest Management. Landowner may conduct Forest Management Activities on the Protected Property provided the following conditions are met:

4.6.1. Forest Management Activities Implementation.

- A. Forest Management Activities are conducted and implemented in accordance with the Forest Management Plan (FMP);
- B. Forest Management Activities are conducted and implemented in accordance with the Multi-Resource Management Plan (MRMP);
- C. Forest Management Activities are conducted and implemented in accordance with pertinent Best Management Practices as described in “Best Management Practices for Forestry: Protecting Maine’s Water Quality (2017)” or its successor documents or an alternative that is approved in writing by the Holder;
- D. Forest Management Activities are conducted and implemented pursuant to local, state, and federal regulations and laws.
- E. Forest Management Activities are conducted and implemented in a manner that over periods of the FMP, shall not exceed the Sustainable Harvest Level.

4.6.2. Sustainable Forest Management Principles. Forest Management Activities shall be implemented in a manner that to the extent reasonably practicable, achieves each of the following Principles (the “Sustainable Forest Management Principles”):

- A. Conservation and promotion of the ecological health and forest productivity of the forest;
- B. Maintenance of a diversity of forest age classes across the landscape and promotion of native species;
- C. Conservation of the aesthetic values of the Protected Property;
- D. Protection of water quality;
- E. Maintenance of soil productivity;
- F. Conservation of native plant and animal species and natural communities;

- G. Compliance with the Sustainable Harvest Level; and
- H. Compliance with the Multi-Resource Management Plan.

4.6.3. Forest Management Plan. The Parties agree that Forest Management Activities on the Protected Property shall be performed under the supervision of a Maine licensed forester and in accordance with a Forest Management Plan (“FMP”) prepared by a Maine licensed forester which shall be consistent with the Purposes of this Conservation Easement and the Sustainable Forest Management Principles as stated in 4.6.2 of this Conservation Easement. The purpose of the Forest Management Plan is to guide Forest Management Activities so as to be consistent with and in compliance with the terms and conditions of this Conservation Easement. The Landowner and Holder acknowledge that the Forest Management Activities implemented and outcomes resulting on the Protected Property will determine the compliance with this Conservation Easement. The Forest Management Plan will contain the following information:

- A. A statement of the Landowner’s long term (between ten and twenty years from the date of the Forest Management Plan) and short term (less than ten years from the date of the Forest Management Plan) sustainable forest management goals;
- B. A description of the Protected Property’s current forested and other natural resource conditions, including maps identifying timber stand types and level of maturity, natural and physical features, and Conservation Values;
- C. A determination of Sustainable Harvest Level and a description of the relationship between projected harvests and the requirements of this Conservation Easement, showing that the Protected Property will be managed to allow for a continuing, renewable and long-term source of forest products;
- D. An explanation of how the Sustainable Forest Management Principles set forth in Section 4.6.2. are being addressed by means of the following forestry measures and practices:
  - 1. Stand quality and stocking level: assessments of species composition and age classes, tree size and stocking, and timber quality, with measures to ensure that forest health is maintained or improved;
  - 2. Sensitive sites: protection of documented rare, threatened, or endangered species and habitats, rare natural communities and other unique and fragile natural areas, and known and documented archeological sites;



3. Productive capacity: practices to protect and maintain soil productivity, water quality, riparian areas, and other unique natural resources;
4. Forest diversity: practices to encourage the full range of site-adapted native species, including a well balanced range of forest age classes, and forest ecosystem functions;
5. Wildlife management: prescriptions to retain or create desirable wildlife habitats, including snags, cavity trees, woody debris, mast production, vernal pools, riparian habitat, deer wintering habitat and overall biological diversity;
6. Pesticide and herbicide: practices to minimize the need for use of pesticides and herbicides and employ current best management practices;
7. Invasive species: identification of invasive species present, and methods for their control or removal, as appropriate and feasible; and
8. Forest health: practices to promote forest health or to mitigate greater damage to the Conservation Values of the Protected Property due to natural causes beyond Landowner's control, such as fire, insect or disease infestation.

4.6.4. Review of Forest Management Plan. To assist the Holder and the Landowner in fulfilling their responsibilities under the terms of this Conservation Easement, the Landowner shall provide the Holder with a copy of the Forest Management Plan in existence at the time of the grant of this Conservation Easement, if one exists, and within twelve months after the grant of this Conservation Easement shall provide, at Landowner's cost, a Forest Management Plan satisfying the requirements of Section 4.6.3.; thereafter, the Landowner shall provide the Holder with any subsequent revisions to such FMP or any new Forest Management Plan at the Landowner's cost promptly following completion. Upon the transfer of the Protected Property, the transferee shall within twelve months after the transfer, provide at transferee's cost a Forest Management Plan satisfying the requirements of Section 4.6.3. The Parties acknowledge that the Holder shall review such FMP for consistency with the Purpose and terms of this Conservation Easement and the Sustainable Forest Management Principles. If the Holder finds that any portion of the Forest Management Plan is inconsistent with the Purpose and terms of this Conservation Easement or that resulting Forest Management Activities could potentially result in a violation of this Conservation Easement, the Holder may provide written comments to the Landowner identifying those portions of the Plan and explaining any inconsistencies with the terms of this Conservation Easement.

4.6.5. Modifications in the Case of Natural Events. The Parties agree that in the event of a hurricane, fire, flood or similar event or if an insect, disease, or forest health pest outbreak occurs, sanitation or salvage harvests may be necessary and could result in a proposed deviation from the Sustainable Harvest Level. Landowner shall provide notice to Holder 30 days in advance of such a harvest commencing. Landowner and Holder also agree that in such events both parties will review and approve in writing any modifications to the standards outlined in the MRMP relative to planned harvesting.

4.6.6. Management of Non-Commercial Vegetation. Landowner may manage non-commercial vegetation by cutting, pruning and planting without the requirement of a FMP as necessary to exercise uses permitted hereunder and to accommodate permitted recreational, cultural, and motorized uses permitted herein. Managing non-commercial vegetation includes the removal of vegetation for safety purposes, to remove invasive, non-native species of plants that could provide a threat to the Conservation Values, and to permit harvesting of woody and non woody vegetation in forested and unforested areas for medicinal, craft and ceremonial purposes important to the Wabanaki, provided that all vegetation management shall be conducted in a manner that minimizes adverse impacts on the Conservation Values of the Protected Property. The incidental sale of vegetation cut or removed from the Protected Property in the exercise of Landowner's non-commercial vegetation management rights shall not require a FMP, and need not be addressed in the Forest Management Plan.

4.7 Multi-Resource Management Plan. Pursuant to Section 4.6 of the Conservation Easement, the purpose of the Multi-Resource Management Plan (MRMP) is to guide Forest Management Activities so as to be in compliance with the terms and conditions of this Conservation Easement. The Multi-Resource Management Plan has been crafted both to protect the Conservation Values of the Protected Property and allow its continued operation as a working forest in accordance with the terms and conditions of this Conservation Easement. All Forest Management Activities, except timber cruising and resource evaluation, shall be conducted in accordance with the MRMP. The MRMP shall remain in effect until amended or modified by the Parties, pursuant to Section V. of the MRMP.

Unless otherwise specified herein, Landowner is hereby responsible and liable for the compliance of Landowner's employees, agents, contractors, and designees with the standards, policies, programs, practices and agreements set forth in the MRMP, when said parties are engaged in Forest Management Activities and other actions covered by the requirements of this MRMP in the capacity of employees, agents, contractors and designees for Landowner.

The Parties expect that the standards set forth herein and other actions required in the Multi-Resource Management Plan may require amending from time to time, based upon the results of audits, research, or other advances in knowledge and understanding of the regional forest ecology and habitats. No such amendment—or

any revision or subsequent version of the MRMP--may be any less protective of the Conservation Values than the standards in effect prior to any such amendment, revision or version, unless additionally agreed to by the state resource agency primarily responsible for mapping and managing said resource. The MRMP shall remain in effect until amended or modified by the Parties, at which time the amended or modified form of the MRMP shall remain in effect. No amendment to the MRMP may become effective until agreed to by Landowner and Holder, which shall be demonstrated by a written agreement with the new terms. Holder will keep an accurate copy of the current MRMP in their files and will make the current MRMP available to successors in interest to the Protected Property or any portion thereof. Notices hereunder shall be given as specified in the Conservation Easement. The terms of the MRMP shall transfer to future owners in the case of a transfer of the Protected Property.

#### 4.8. Surface Alterations.

4.8.1. Existing Surface Alterations. As of the date of this Conservation Easement, there are no surface alterations on the Protected Property except unpaved trails, ATV trails, skid trails, unpaved woods roads and timber landing areas, gravel pits, erosion control systems, or alterations associated with existing structures and utilities (collectively "Surface Alterations"), as shown in the Baseline Documentation Report. Existing surface alterations may be maintained or replaced with like surface alterations having the same or similar purpose. All such maintenance or replacement of existing surface alterations shall be conducted so as to minimize adverse impacts on the Conservation Values.

4.8.2. Additional Surface Alterations. No additional Surface Alterations, filling, dumping, excavation, extraction, new roads, surface or subsurface mining, or other alteration may be made to the surface or subsurface of the Protected Property or to its surface or ground waters, or wetlands, except as permitted in Sections 4.5, 4.6, 4.8, 4.9, 4.10, and 4.11 and for the creation, maintenance and use of gravel found on the Protected Property provided that:

4.8.2.1. Gravel Pit Size and Number. The exposed mineral surface of any single gravel pit shall not exceed 0.5 acres in size and the cumulative exposed mineral surface of all such gravel pits shall not exceed 1.5 acres in aggregate at any point in time;

4.8.2.2. Gravel Pit Regulations. Gravel extraction activities shall (a) not be located within any of the site specific areas mapped and addressed in the Multi-Resource Management Plan; and (b) be managed and maintained in accordance with federal, state and local laws and regulations; and

4.8.2.3. Use of Gravel Extracted. The use of gravel and any other materials extracted from the gravel pits shall be used on the Protected Property and adjacent or appurtenant roads to the Protected Property to



facilitate and enhance allowed uses outlined in this Conservation Easement and for no other commercial uses.

- 4.9. Excavation of Minerals, Geothermal Resources and Hydrocarbon. To the extent that at the time of this grant, or any time thereafter, Landowner owns or has the right to geothermal resources, minerals, hydrocarbon, groundwater, or any other deposits, or the right to limit access thereto, there shall be no exploration for, or development and extraction of, geothermal resources, minerals, hydrocarbon, groundwater, or any other deposits by any surface or sub-surface mining or any other method on the Protected Property except as provided for in Section 4.8. Surface Alterations, and Landowner shall not transfer, encumber, sell, lease, or otherwise separate these rights from the Protected Property.
- 4.10. Waste; Hazardous Substance. There shall be no placing, filling, storing or dumping on the Protected Property of rubbish, garbage, debris, waste materials, landfill, or any hazardous substance, material, or waste except as follows:
  - 4.10.1. Use of Hazardous Materials. The Landowner may use and transport in appropriate containers designed and maintained to avoid spillage or other contamination of the surrounding environment, hazardous substances or materials generated or used in connection with permitted uses (including oil, diesel, gasoline, pesticides and other chemicals) and upon cessation of the use of such substances or materials, shall remove such substance or material from the Protected Property as soon as reasonably possible. Storage of hazardous substances, materials, or wastes is prohibited except for limited temporary storage for a specific planned use allowed under this Conservation Easement and which shall be consistent with protecting the Conservation Values.
  - 4.10.2. Storage and Removal of Rubbish, Garbage, Debris, and Waste Materials. The Landowner shall collect and store in appropriate containers rubbish, garbage, debris, and waste materials generated in connection with permitted management activities and shall remove such material from the Protected Property at reasonable intervals, which will be no less frequently than annually. The Landowner shall establish policies to provide for the removal of rubbish, garbage, debris, abandoned or unserviceable vehicles, and waste materials resulting from permitted activities, including recreational activities by the public. For the purposes of this Conservation Easement, logging debris is not considered rubbish, garbage, debris or waste material.
- 4.11. Scientific Research. Scientific research, including but not limited to wildlife management and archeological research may be conducted on the Protected Property including the placement of temporary or permanent plot markers and ancillary research equipment provided that they minimize adverse impacts on Conservation Values and are consistent with the Purposes and terms of this Conservation Easement. Landowner further reserves the right to permit limited archeological and ecological study of the Protected Property, including excavation of sites, provided that all such work must be conducted in accordance with applicable then-current professional or

Wabanaki tribal standards, and the disturbed area must be restored to its natural appearance as soon as reasonably possible after completion.

## **5. RIGHTS AND OBLIGATIONS OF THE HOLDER FOR MONITORING AND ENFORCEMENT PURPOSES.**

To accomplish the Purpose, the following rights and easements are granted to and obligations are imposed upon the Holder:

- 5.1. Affirmative Rights of the Holder related to Monitoring, Enforcement and Administration. The Holder is hereby granted the right to assure compliance with the terms of this Conservation Easement and the right to preserve and protect the Conservation Values of the Protected Property. In connection with such right, the Holder shall have the right to enter the Protected Property at any reasonable time and in any reasonable manner, being the same rights of entry and manner as afforded the Landowner through provisions of this Conservation Easement and over any and all rights of way and roads over which the Landowner has rights of access, subject to the requirement of this paragraph and Section 6, for the purposes of inspection, monitoring, enforcement and remedying any violations of this Conservation Easement.
- 5.2. Annual Meeting. Absent an agreement between the Parties to the contrary, the Landowner and the Holder, or their designees, shall meet annually at a date, location and time convenient for the Parties to review the Landowner's management activities, including more specifically:
  - (a.) information on recreational infrastructure development and management;
  - (b.) information on location, size, harvest method, forest type, volume removed, for all harvest blocks planned for the coming year;
  - (c.) information on location, size, harvest method, forest type, volume removed, for all harvest blocks completed in the previous year;
  - (d.) review the status of Forest Management Plan, the Multi-Resource Management Plan including review and discussion of new or changed information related to the resources subject to the MRMP;
  - (e.) implementation of the Sustainable Forest Management Principles;
  - (f.) review of the Holder's monitoring activities; and
  - (g.) discussion of any questions or concerns regarding the Protected Property and the exercise of the rights by either party under this Conservation Easement.
- 5.3. Annual Reporting. Following each Annual Meeting, Holder shall provide to the Landowner a summary written report covering such items as monitoring undertaken during the year; any easement violations found and actions taken as a result; potential violations or emerging issues identified by the Holder or brought to the attention of Holder by any other entity, and any additional information relevant to monitoring that occurred during the year. Such written reports shall be maintained by Holder in its permanent records.

- 5.4. Access by Roads. Holder shall have the same vehicular access rights to the Protected Property as Landowner. If the Landowner has gated roads, but utilizes the roads beyond the gates, the Landowner shall provide the Holder with vehicular access through the gates and on and across such roads. Further, the Holder shall not use roads in a manner that could reasonably be anticipated to result in road damage with the exception of reasonable wear and tear.
- 5.5. No Obligation to Create or Maintain Access. The Landowner is under no obligation to create or maintain vehicular access for the Holder or any other entity or individual. Further, the Holder's rights of access do not include any rights of construction or maintenance related to vehicular access or any other affirmative right to undertake site alteration or to place access-related structures or improvements on the Protected Property or on any other lands of the Landowner.
- 5.6. No Separate Assignment. The Holder's access rights are not assignable except in connection with the permitted assignment by the Holder of this Conservation Easement.

## **6. THE HOLDER'S REMEDIES.**

- 6.1. Notice of Violation; Corrective Action. If the Holder becomes aware of a violation of this Conservation Easement, except as provided in Section 6.4, the Holder shall notify the Landowner of such violation and request that the Landowner cure the violation, and, if the violation involves damage to the Protected Property resulting from any use or activity that the Holder determines, in its reasonable judgment, to be inconsistent with the Purpose, that the Landowner restore, to the extent practicable, the portion of the Protected Property so damaged to a condition substantially similar to that which existed prior to the violation.
- 6.2. Injunctive Relief. Except as provided in Section 6.4, if the Landowner does not cure the violation within thirty (30) days after receipt of notice thereof from the Holder, or under circumstances where the violation cannot reasonably be cured within said period, does not begin curing such violation within said period, and/or does not continue diligently to cure such violation until finally cured, the Holder may bring an action at law or in equity in court of competent jurisdiction to enforce the terms of this Conservation Easement, to enjoin the violation by temporary or permanent injunction, *ex parte* as necessary, and to require the restoration of the Protected Property to the condition substantially similar to that which existed prior to injury to the extent such restoration is practicable. Such right to injunctive relief shall not require the posting of any bond or other security or the burden of proving either actual damages or the inadequacy of otherwise available legal remedies.
- 6.3. Damages and Fees. In addition to the injunctive relief available under Section 6.2, in the event of a determination that the Landowner has violated this Conservation Easement, the Holder will be entitled to recover reasonable damages for violation of the terms of this Conservation Easement, together with related reasonable experts', surveyors' and attorneys' fees and expenses. If the violation involves a harvest in



excess of that permitted hereunder, other than excessive harvest within the riparian corridor, the Parties agree that the appropriate measure of damages shall be the stumpage value, at the time of the improper harvest, together with the cost of implementing any remediation plan approved by the Holder. If the excessive harvest occurs within the Riparian Management Buffer or Area, as defined in the MRMP, the Parties agree that the appropriate measure of damages shall be twice the stumpage value, at the time of the harvest, together with the cost of any additional remediation measures reasonably necessary or appropriate to maintain water quality. The Parties agree that these measures of damages represent appropriate and reasonable liquidated damages, reasonably reflecting the expected actual damages, and do not constitute a penalty, and that any other measure of actual damages would be difficult or unreasonably expensive to determine. If a court finds that a violation was knowing, intentional, willful or malicious, the court may award additional monetary or punitive damages, as it deems appropriate. Any damages calculated and due under this Conservation Easement are separate from and in addition to any fees or penalties levied by a governmental authority for any violation of local, state, or federal laws or regulations for the same action.

- 6.4. Emergency Enforcement. If the Holder, in its reasonable discretion, determines that circumstances require immediate action to prevent or mitigate significant damage to the Conservation Values of the Protected Property resulting from an alleged violation of the terms of this Conservation Easement, the Holder may enter upon the Protected Property for the purpose of assessing damage or threat to the Conservation Values thereon resulting from a violation of the terms of this Conservation Easement and determining the nature of curative or mitigation actions that should be taken; and pursue its remedies under this Section with at least twenty-four (24) hours' prior notice to the Landowner, but without waiting for the cure or notice period provided under this Section to expire.
- 6.5. Costs of Enforcement. In the event that a circumstance of Landowner's noncompliance with the Conservation Easement is corrected through negotiation and voluntary compliance, the Landowner shall reimburse Holder for all reasonable costs and fees incurred in investigating the non-compliance and securing its correction. In the event that Holder prevails through judicial enforcement, Holder shall be entitled to an award of its reasonable costs and fees, including experts', surveyors', and attorneys' fees and any other payments ordered by such decision-maker. In all other circumstances, each party shall bear its own costs and fees of dispute resolution. Any such costs and fees reimbursement shall apply whether Holder is a plaintiff or defendant in a judicial or administrative action or proceeding, and regardless of whether the action is styled as a declaratory judgment action or some other kind of action.
- 6.6. The Holder's Discretion. Enforcement of the terms of this Conservation Easement shall be at the discretion of the Holder, and any forbearance by the Holder to exercise its rights under this Conservation Easement in the event of any breach of any term of this Conservation Easement by the Landowner shall not be deemed or construed to be a waiver by the Holder of such term or of any subsequent breach of the same or any

other term of this Conservation Easement or of any of the Holder's rights under this Conservation Easement. No delay or omission by the Holder in the exercise of any right or remedy upon any breach by the Landowner shall impair such right or remedy or be construed as a waiver. No right granted to the Holder and no right or restrictions enforceable by the Holder arising under this Conservation Easement shall be reduced, extinguished, or otherwise altered in any manner adverse to the right, title, and interest of the Holder through prescription, adverse use, statute of limitations, waiver, laches, or any failure of the Holder to exercise its rights.

- 6.7. Actions by Third Parties. Landowner shall take all reasonable actions, consistent with customary standards for the management of comparable areas utilized for the same purposes as the Protected Property, to prevent or halt third parties from violating this Easement. Landowner and Holder, together or unilaterally, may take such action as may be reasonably necessary to remedy acts of authorized or unauthorized third parties that constitute a violation of this Easement. Furthermore, in the event of violations of this Easement caused by acts of third parties, at Holder's option, Landowner agrees to assign their rights of action to Holder, to join in any suit, and/or to appoint Holder its attorney-in-fact for the purposes of pursuing enforcement action. Landowner shall remain responsible for violations of this Easement caused by acts of Landowner's employees, contractors, agents, invitees, guests, licensees, and other expressly or impliedly authorized third parties. As to violations arising from the acts or omissions of unauthorized third parties, the Landowner shall remain responsible for restoration of the Protected Property to a condition of compliance with this Easement, and Holder shall have a right to enforce this Easement directly against the Landowner if the Landowner fails to cooperate with the Easement Holder in all reasonable respects to halt or abate the violation resulting from such acts or omissions, or fails to promptly report a known or suspected violation to the Holder..
- 6.8. Acts Beyond Landowner's Control. Nothing contained in this Conservation Easement shall be construed to entitle Holder to bring any action against the Landowner for any injury to or change in the Protected Property resulting from causes beyond the Landowner's control, including without limitation, government action, fire, flood, storm, changes in climatic condition, catastrophic insect infestation, disease, acid rain or other airborne pollutants introduced into the atmosphere by third parties, naturally occurring earth movement and other similar natural events, or from any prudent action taken by the Landowner under what the Landowner reasonably and in good faith perceives to be emergency conditions to prevent, abate, or mitigate significant injury to the Protected Property resulting from such causes. Nothing contained in this Conservation Easement shall be construed to entitle the Holder to bring any action against the Landowner for any injury to or change in the Protected Property or any injury to any person or property resulting from the actions of the Holder or resulting from the actions of any person whose presence on the Protected Property arises out of the exercise of the Holder's rights hereunder.

## **7. OTHER RIGHTS NOT IMPAIRED OR ENLARGED.**

- 7.1. No Other Enforcement Rights. This Conservation Easement shall not be construed to entitle any person or entity other than the Holder or its duly authorized agents, to enforce any of the terms or conditions of this Conservation Easement against the Landowner, except in connection with the permitted assignment by the Holder of this Conservation Easement as permitted in Section 12, or except the Maine Attorney General, as provided by Title 33 M.R.S. Sections 476 et seq., as amended. Nothing herein should be construed to grant abutting or nearby landowners or the public standing to bring an action hereunder, nor any rights in the Protected Property by adverse possession or otherwise.
- 7.2. No Additional Assumption of Responsibility. Nothing in this Conservation Easement shall be interpreted as an assumption of responsibility by, or basis for liability on the part of, the Landowner for any injury to person or damage to property or loss of life that may be sustained by any person while on the Protected Property pursuant to the Conservation Easement granted hereunder to the Holder or sustained by any such person as a result of any entry on or use of the Protected Property by any persons other than the Landowner, its agents, employees, contractors, licensees and invitees. The Landowner specifically retains all the protections provided under Maine law to owners of land, including the protections contained in 14 M.R.S. § 159-A.
- 7.3. Private Action. Actions taken by the Landowner on the Protected Property after the date of this Conservation Easement shall continue to be treated as private action and not public action (in other words, not the action of the federal, state, or local government) for the purposes of laws and regulations governing public lands, including, the Endangered Species Act, 16 U.S.C.A. §§ 1531, *et seq.*, and the National Environmental Policy Act, 42 U.S.C.A. §§ 4321, *et seq.* In the event that any interests acquired by the Holder are subject to compliance with any law or regulation, said compliance shall not limit, delay, or otherwise interfere with the rights of the Landowner as set forth in this Conservation Easement.
- 7.4. No Enlargement or Extension of the Holder's Rights. No right granted to the Holder and no right or restriction enforceable by the Holder arising under this Conservation Easement shall be enlarged, extended, or otherwise altered in any manner adverse to the right, title and interest of the Landowner through prescription, adverse use, waiver, laches or any failure of the Landowner to exercise its rights.
- 7.5. Additional Conservation Actions. Nothing contained in this Conservation Easement shall be construed either to limit the Landowner's rights to take additional conservation actions, such as further restrictions on the use of all or a portion of the Protected Property in order to protect the resources and Conservation Values of the Protected Property.



- 7.6. Taxes. Landowner shall pay and discharge when due all property taxes and assessments imposed upon the Protected Property and any uses thereof, and avoid the imposition of any liens that may impact the Holder's rights hereunder. Landowner shall keep the Protected Property free of any liens or encumbrances that may adversely impact Holder's rights hereunder, including without limitation those arising out of any work performed for, materials furnished to, or obligations incurred by Landowner; and Landowner shall promptly notify Holder of the filing or recording of any such lien or encumbrance. If discharge of the lien or encumbrance is necessary to protect the Holder's interest in the Protected Property and to assure the continued enforceability of this Conservation Easement, and Landowner has not taken action to discharge such lien or encumbrance (whether by payment, legal challenge to its validity, or otherwise), Holder may, at its discretion, pay any outstanding taxes, assessments, liens or encumbrances, and shall then be entitled to reimbursement by Landowner, together with interest at the then-prevailing statutory post-judgment interest rate in Maine under Title 14 M.R.S. Section 1602-C or successor provisions thereof, calculated from the date of Holder's payment. Landowner agrees and authorizes Holder to record a notice of a claim to proceeds on the Protected Property to secure Holder's right to reimbursement under this Section, which claim will be effective as of the date of Holder's payment. In any collection process or court action brought by Holder for reimbursement in which Holder is the prevailing party, Holder shall be entitled to recover its costs and expenses, including, without limitation, reasonable attorney's fees.
- 7.7. Landowner acknowledges that Holder has neither possessory rights in the Protected Property, nor any responsibility or right to control, maintain, or keep up the Protected Property. Landowner shall retain all responsibilities and shall bear all costs and liabilities of any nature related to the ownership, operation, upkeep, improvement, and maintenance of the Protected Property.

## **8. TERMINATION.**

- 8.1. The Parties agree that the grant of this Conservation Easement gives rise to a property right that vests immediately in Holder.
- 8.2. If either the Holder or the Landowner receives notice of the actual or threatened exercise of the power of eminent domain (hereinafter a "Taking") with respect to any interest in or any part of the Protected Property, the Party who receives the notice shall promptly notify the other. Either Party may separately, or both Parties may jointly, take such legal action as may be deemed necessary to: (i) challenge the Taking; (ii) challenge the amount or the allocation of any award tendered by the Taking authority; and/or (iii) otherwise participate in, challenge or appeal such proceedings, findings or awards. In the event the Parties act jointly, any third-party counsel and consultants (including appraisers) hired by either party shall be reasonably acceptable to the other party. Absent a written agreement to the contrary, each party shall be responsible for its own costs and legal fees.

8.3. This Conservation Easement may be extinguished or terminated only by judicial order in a court of competent jurisdiction, including a Taking in accordance with subsection 8.2 above. It is the intention of the parties that an extinguishment or termination be approved by a court only if all of the conservation purposes of this Conservation Easement are impossible to accomplish, and if both Landowner and Holder agree. Should this Conservation Easement be terminated or extinguished as provided in this paragraph, in whole or in part, Holder shall be entitled to be paid, in accordance with 33 M.R.S. § 477-A(2)(B), at least the increase in value of the Landowner's estate resulting from such extinguishment, as determined by the court, or in the absence of such court determination, by the agreement of the parties or, in the absence of such agreement, by an independent appraiser mutually selected by Landowner and Holder. Holder shall use its share of the proceeds or other moneys received under this paragraph in a manner consistent with the Conservation Purposes of this Conservation Easement. Landowner agrees and authorizes Holder to record a notice of a lien on the Protected Property which lien will be effective as of the date of such extinguishment, to secure its rights under this Paragraph.

## **9. AMENDMENT AND DISCRETIONARY APPROVALS.**

Landowner and Holder acknowledge that, in view of the perpetual nature of this Conservation Easement, they are unable to foresee all potential future land uses, future technologies and future evolution of the land and other natural resources, and other future occurrences affecting the Purposes of this Conservation Easement. Holder therefore may determine whether (a) proposed uses or proposed improvements not contemplated by or addressed in this Conservation Easement or (b) alterations in existing uses or structures, are consistent with the Purposes of this Conservation Easement.

Any legally permissible amendment hereto, and any discretionary approval by Holder contemplated by this Conservation Easement, may be granted only if the Holder has determined in its sole discretion, that the proposed use furthers and is not inconsistent with the Purposes of this Conservation Easement, substantially conforms to the intent of this grant, meets any applicable conditions expressly stated herein, does not confer an impermissible private benefit on Landowner, and does not materially increase the adverse impact of expressly permitted actions under this Conservation Easement on the Conservation Values. Holder has no right or power to approve any activity or amendment that would be inconsistent with the Purpose of this Conservation Easement, that would limit the term or terminate this Conservation Easement, or that would impair the qualification of this Conservation Easement or the status of the Holder under any applicable laws, including Title 33 M.R.S. Section 476 et seq., or successor provisions thereof. This Conservation Easement may not be amended in such a manner as to materially detract from the Conservation Values intended for protection without the prior approval of the court in an action in which the Attorney General is made a party. Should an amendment limit the term or result in the partial or complete termination of this Conservation Easement, Holder shall be entitled to be paid no less than as calculated under Section 8.3 of this Conservation Easement. Amendments will become effective upon recording at the Franklin County Registry of Deeds.

## **10. ASSIGNMENT.**

This Conservation Easement is assignable, but only to an entity that satisfies the requirements of Section 170(h)(3) of the Internal Revenue Code, (or successor provisions thereof) and the requirements of Section 476(2) of Title 33 of the Maine Revised Statutes, as amended (or successor provisions thereof), and that as a condition of transfer, agrees to uphold the conservation Purpose of this grant.

## **11. SUBSEQUENT TRANSFERS.**

Except as specifically provided in Section 4.2., nothing in this Conservation Easement shall be construed to prevent Landowner from selling or otherwise conveying or transferring the Protected Property or any common and undivided interest in the Protected Property to a third party, subject to the terms of this Conservation Easement. Landowner agrees to incorporate the terms of this Conservation Easement by reference in any deed or other legal instrument by which Landowner divests itself of any interest in all or a portion of the Protected Property, including a security or leasehold interest. Landowner agrees to give written notice to Holder of the transfer of any interest in the Protected Property thirty (30) days prior to the date of such transfer. Landowner shall provide Holder documentation recorded at any registry of deeds upon completion of such transfer. The failure of Landowner to perform any act required by this section shall not impair the validity of this Conservation Easement or limit its enforceability in any way.

Prior to transfer, and in the event of a legal division of the Protected Property, the current Landowner shall provide the Holder with an accounting of the Sustainable Harvest Level as it is currently known and anticipated at the time of said transfer. Additionally, the Landowner and future interest holder shall agree on and report to Holder an allocation of allowed manageable assets (which may include gravel pit rights, further division rights, remaining Sustainable Harvest Level, etc.) to ensure continued compliance with the Conservation Easement.

## **12. NOTICES AND REQUESTS FOR APPROVAL.**

- 12.1. Written Notices and Requests. All notices, requests for approval, and approvals under this Conservation Easement shall be in writing and effective upon receipt or refusal and delivered by hand or sent by mail, postage prepaid, certified or registered mail, return receipt requested, or overnight delivery service providing proof of receipt, addressed as follows, unless one has been notified by the other of a change of address or change of ownership:

To Landowner:

Rangeley Lakes Heritage Trust, Inc.  
2424 Main Street  
Rangeley, ME 04970



To Holder:

Forest Society of Maine  
c/o President/CEO  
209 State Street, 2<sup>nd</sup> Floor  
Bangor, Maine 04401

In the event that notice to the Landowner or Holder at the last address on file with the other party is returned as undeliverable that party may comply with the notice provisions as follows: the Holder shall provide notice by regular mail to the Landowner's last known address on file with the taxing authority with jurisdiction over the Protected Property; or in the case of notice to the Holder, or to a corporate Landowner, the Party will provide notice by regular mail to the address on file with the Secretary of State, State of Maine, and the mailing of such notice shall be deemed compliance with the notice provisions of this Conservation Easement.

- 12.2. Additional Notice Methods. In addition to the methods set forth in Section 12.1., a notice or request for approval or any other communication may be sent by electronic mail or other electronic communication ("email") only if an authorized agent of the receiving party has consented to receiving that type of notice or communication by email at a specific address and the recipient, by an email sent to the email address for the sender or by the same email returned to the originating address for the sender, or by a notice delivered by another method in accordance with Section 12.1., acknowledges having received that email. An automatic "read receipt" shall not constitute acknowledgment of an email for purposes of this Section 12.2.
- 12.3. Time for Notice and Reply. Where Landowner is required to provide notice to Holder pursuant to this Easement, such notice shall be given in writing fourteen (14) days prior to the event giving rise to the need to give notice except as otherwise specifically provided herein.
- 12.4. Time for Approval and Reply. Where Landowner is required to obtain Holder's prior written approval, such request shall be given in writing thirty (30) days prior to undertaking the proposed activity except as otherwise specifically provided herein. Holder, upon receipt of Landowner's request, shall acknowledge receipt of the same. Following such review, Holder shall grant, grant with conditions, or withhold its approval. Failure to approve Landowner's request within thirty (30) days shall be deemed a constructive denial of such request. A constructive denial is not a decision by Holder based on the merits of Landowner's request, and Landowner may resubmit the same or a similar request for approval. No proposed activity may proceed without Holder's written approval as provided herein.

### **13. RECORDING.**

Original counterparts of this Conservation Easement shall be recorded by Holder at its expense in the Registry of Deeds, Franklin County, Maine. Holder may re-record this Conservation Easement at Holder's expense at any time as may be required to preserve its rights in this Conservation Easement.

### **14. MERGER.**

The Landowner and Holder agree that the terms of this Conservation Easement shall survive any merger of the fee and conservation easement interest in the Protected Property.

### **15. ACCRETION AND RELICTION.**

In the event that changing water levels or water courses or water action such as accretion or reliction leads to the emergence of new land within or changes to the boundaries of the Protected Property, it is the intention of the Landowner and the Holder that such new land shall be subject to the terms of this Conservation Easement to the extent that Landowner is the owner or has management rights in such land as a result of such changing water levels or water courses or water action.

### **16. ENVIRONMENTAL WARRANTY.**

Nothing in this Conservation Easement shall be construed as giving rise to any right or ability in Holder to exercise physical or management control over the day-to-day operations of the Protected Property, or any of Landowner's activities on the Protected Property, or otherwise to become an operator with respect to the Protected Property within the meaning of The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA) or any corresponding state or local statute or ordinance.

Landowner warrants that it has no actual knowledge of a release of hazardous substances, materials, or wastes on the Protected Property, as such substances, materials, or wastes are defined by applicable law, and hereby promises to indemnify Holder against, and hold Holder harmless from, any and all loss, cost, claim (without regard to its merit), liability or expense (including reasonable attorneys' fees) arising from or with respect to any release of hazardous substances, materials, or waste in violation of environmental laws.

If at any time after the date of this Conservation Easement there occurs a release in, on, or about the Property of any substance, material, or waste now or hereafter defined, listed, or otherwise classified pursuant to any federal, state, or local law, regulation, or requirement as hazardous, toxic, polluting, or otherwise contaminating to the air, water, or soil, or in any way harmful or threatening to human health or the environment, Landowner agrees to take all steps that may be required under federal, state, or local law necessary to assure its containment and remediation, including any cleanup.

### **17. GENERAL PROVISIONS.**

- 17.1. Controlling Law; Compliance with Laws. This Conservation Easement is created pursuant to the Maine Conservation Easement Act at Title 33, Maine Revised Statutes, Sections 476 through 479-C, inclusive and shall be construed in accordance with the laws of the State of Maine.
- 17.2. Including; Any. As used in this Conservation Easement, the words "include" or "including" means "including without limitation," and "any" means "any and all."
- 17.3. Liberal Construction. Any general rule of construction to the contrary notwithstanding, this Conservation Easement shall be liberally construed in favor of the grant to effect its Purpose and the purpose and the policy of 33 M.R.S. §§ 476 and 479-C inclusive, as amended. If any provision of this Conservation Easement is found to be ambiguous, an interpretation consistent with the Purpose that would render the provision valid shall be favored over any interpretation that would render it invalid.
- 17.4. Severability. If any provision of this Conservation Easement, or its application to any person or circumstance, is found to be invalid, the remainder, or the application of such provision to persons or circumstances other than those as to which it is found to be invalid, as the case may be, shall not be affected thereby so long as the Purpose of this Conservation Easement can still be carried out.
- 17.5. Entire Agreement. This Conservation Easement, as supplemented by the Forest Management Plan, the Multi-Resource Management Plan, and the Baseline Documentation Report, contains the entire agreement of the Parties with respect to its subject matter and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement, all of which are merged in this Conservation Easement. This Conservation Easement may not be amended except as provided in Section 9.
- 17.6. No Forfeiture. Nothing contained herein is intended to result in a forfeiture or reversion of Landowner's fee title in any respect.
- 17.7. Successors. This Conservation Easement shall be binding upon, and inure to the benefit of, the Parties and their successors and assigns, and shall continue as a servitude running in perpetuity with the Protected Property.
- 17.8. Captions. Captions used in this Conservation Easement are solely for convenience of reference and shall not be used for construction or interpretation.
- 17.9. Counterparts. Each party may execute this Conservation Easement in counterparts, and each counterpart shall be deemed an original instrument. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.



- 17.10. Construction. In all matters of interpretation, whenever necessary to give effect to any clause of this agreement, the neuter, masculine and feminine include each other, and the singular includes the plural, and the plural includes the singular.
- 17.11. Independent Representation. Landowner and Holder have each retained legal counsel to represent only their respective interests in this transaction. Landowner and Holder acknowledge and agree that they have not received and are not relying upon legal, tax, financial or other advice from each other. Landowner acknowledges that Holder has recommended that it keep independent counsel.
- 17.12 Economic Hardship. In making this grant, Landowner has considered the possibility that uses prohibited by the terms of this Easement may become more economically valuable than permitted uses, and that neighboring properties may in the future be put entirely to such prohibited uses. In addition, the unprofitability of conducting or implementing any or all of the uses permitted under the terms of this Conservation Easement shall not impair the validity of this Conservation Easement or be considered grounds for its termination or extinguishment. It is the intent of both Landowner and Holder that any such economic changes shall not be deemed to be changed conditions or a change of circumstances justifying the judicial termination, extinguishment or amendment of this Conservation Easement.

[THIS SPACE INTENTIONALLY LEFT BLANK]

This Conservation Easement is granted to Holder subject to all rights and reservations of record.

**IN WITNESS WHEREOF**, the Parties hereto have set their hands and seals this \_\_\_\_ day of \_\_\_\_\_, 2023.

**LANDOWNER**

**Rangeley Lakes Heritage Trust, Inc.**

\_\_\_\_\_  
Witness

By: \_\_\_\_\_  
David Miller  
Its Executive Director

State of Maine  
Cumberland County

\_\_\_\_\_, \_\_\_, 2023

Personally appeared before me, David Miller, Executive Director of Rangeley Lakes Heritage Trust, Inc., duly authorized, and acknowledged the foregoing instrument to be his free act and deed in said capacity and the free act and deed of Rangeley Lakes Heritage Trust, Inc.

Before me,

\_\_\_\_\_  
Notary Public/Attorney at Law  
Printed Name:  
My Commission Expires:

## HOLDER ACCEPTANCE

The above and foregoing Conservation Easement was authorized to be accepted by the Forest Society of Maine, the Holder as aforesaid, and the said Holder does hereby accept the foregoing Conservation Easement, by and through Karin Tilberg, its President/CEO, hereunto duly authorized, this \_\_\_\_ day of \_\_\_\_\_, 2023.

### Forest Society of Maine

\_\_\_\_\_  
Witness

By: \_\_\_\_\_  
Karin Tilberg  
Its: President/CEO

STATE OF MAINE  
Cumberland County

\_\_\_\_\_, \_\_\_\_\_, 2023

Personally appeared before me above-named Karin Tilberg, President/CEO of Forest Society of Maine, and acknowledged the foregoing instrument to be her free act and deed in her capacity and the free act and deed of Forest Society of Maine.

Before me,

\_\_\_\_\_  
Notary Public/Attorney at Law  
Printed Name:  
My Commission Expires:



## **EXHIBIT A**

A certain lot or parcel of land, together with all improvements thereon, located in Stetsontown, Franklin County, Maine, being described as follows (the “Protected Property”):

Bounded on the east by land conveyed by Bayroot LLC to Rangeley Lakes Heritage Trust, Inc. by deed dated January 11, 2022 and recorded in Book 4415, Page 163 of the Franklin County Registry of Deeds;

Bounded on the south by land conveyed by Bayroot LLC to Black Brook LLC by deed dated November 5, 2021 and recorded in Book 4393, Page 91;

Bounded on the west by the westerly town line of Stetsontown Township (being the easterly line of Upper Cupsuptic Township); and

Bounded on the north by the northerly line of Stetsontown Township (being the southerly line of Seven Ponds Township).

Being the same property conveyed by deed of Bayroot LLC to Rangeley Lakes Heritage Trust, Inc. of near or even date herewith to be recorded in the Franklin County Registry of Deeds (the “RLHT Deed”).

Said portion being also further bounded and described as follows:

Commencing at a rebar set in 2021 on the northerly town line of Stetsontown Township, being the southerly line of Seven Ponds Township, said rebar lying twenty-five feet (25') westerly of the centerline of the traveled way of Kennebago River Road ( a.k.a. Canada Road), which rebar is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 861,870 U.S. Survey Feet and an Easting of 2,798,393 U.S. Survey Feet and set on an orange blazed line;

Thence South 80° 00' 40" West along said township line a distance of 3,066 feet to the true POINT OF BEGINNING, marked by a rebar set in 2021 on said township line (labeled Pt. T on a plan titled “Perimeter Boundary Survey Showing Tract 1...Stetsontown (T3 R4 WBKP), Maine) dated October 17, 2023 by Plisga & Day, Land Surveyors of Bangor, Maine, to be recorded in the Franklin County Registry of Deeds, and hereinafter referred to as the “Tract 1 Survey”), which rebar is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 861,338 U.S. Survey Feet and an Easting of 2,795,374 U.S. Survey Feet and set on an orange blazed line;

Thence along the west boundary of land of Rangeley Lakes Heritage Trust, Inc. being described in the deed from Bayroot LLC dated January 11, 2022 and recorded in the Franklin County Registry of Deeds in Book 4415, Page 163 (hereinafter called “Tract 2”) South 09° 26' 29" West a distance of 5,750 feet,

more or less, to a point lying 16.5 feet northeasterly of the centerline of the traveled way of Bear Brook Road at the point where an unnamed spur road enters from the northwest (labeled Pt. U on Tract 1 Survey), which point is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 855,667 U.S. Survey Feet and an Easting of 2,794,430 U.S. Survey Feet;

Thence along the west line of Tract 2 turning southeasterly along a line that remains at all times 16.5 feet easterly of and parallel to the centerline of the traveled way of Bear Brook Road a distance of 3,085 feet, more or less, to a point on the centerline of the traveled way of Wiggle Brook Road lying 16.5 feet easterly of the centerpoint of the intersection of the Bear Brook Road and the Wiggle Brook Road;

Thence along the west line of Tract 2 continuing due south to a point lying 25 feet south of the centerline of the traveled way of Wiggle Brook Road (labeled Pt. V on Tract 1 Survey), which Pt. V is located South  $41^{\circ} 23' 47''$  East a distance of 67 feet from a rebar set in 2021, which rebar is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 853,155 U.S. Survey Feet and an Easting of 2,796,078 U.S. Survey Feet;

Thence along the west line of Tract 2 turning westerly and then southerly along a line that remains at all times 25 feet southerly and easterly of and parallel to the centerline of the traveled way of Wiggle Brook Road a distance of 2,650 feet, more or less, to a point lying 25 feet easterly of the centerline of the traveled way of Wiggle Brook Road at the point where the Wiggle Connector Road enters from the southeast, and being 16.5' northeasterly of the centerline of the traveled way of said Wiggle Connector Road (labeled Pt. W on Tract 1 Survey), which Pt. W is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 851,366 U.S. Survey Feet and an Easting of 2,795,222 U.S. Survey Feet;

Thence along the west line of Tract 2 turning southerly and then westerly along a line that remains at all times 16.5 feet easterly and then southerly of and parallel to the centerline of the traveled way of said Wiggle Connector Road (including unused portions formerly of Wiggle Connector Road, if any) a distance of 2,755 feet, more or less, to a point lying 16.5 feet northerly of the centerline of the traveled way of West Wiggle Road that joins from the west (labeled Pt. X on Tract 1 Survey), which Pt. X is located North  $65^{\circ} 11' 20''$  West a distance of 22 feet from a rebar set in 2021, which rebar is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 849,188 U.S. Survey Feet and an Easting of 2,795,213 U.S. Survey Feet;

Thence along the west line of Tract 2 turning southeasterly and then southwesterly along a line that remains at all times 16.5 feet easterly of and parallel to the centerline of the traveled way of said West Wiggle Road a

distance of 8,690 feet, more or less, to a point lying 16.5 feet easterly of the centerline of the traveled way of said West Wiggle Road at the point where the Sol Brook Road enters from the northwest, and 16.5 feet south of an easterly extension of the Sol Brook Road (labeled Pt. Y on Tract 1 Survey), which Pt. Y is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 842,200 U.S. Survey Feet and an Easting of 2,794,838 U.S. Survey Feet;

Thence along the west line of Tract 2 turning northwesterly along a line that remains at all times 16.5 feet southerly of and parallel to the centerline of the traveled way of Sol Brook Road and proceeding 2,755 feet, more or less, to a point lying 16.5 feet southerly of the centerline of the traveled way of Sol Brook Road at a junction of two unnamed woods roads (labeled Pt. Z on Tract 1 Survey), witnessed by a rebar set in 2021, which rebar is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 843,715 U.S. Survey Feet and an Easting of 2,792,742 U.S. Survey Feet;

Thence along the west line of Tract 2 South 04°08'39" East a distance of 7,093 feet, to a point on the centerline of the traveled way of Lincoln Pond Road (labeled Pt. AA on Tract 1 Survey);

Thence along the west line of Tract 2 continuing South 04° 08' 39" East a distance of 33 feet to rebar set in 2021 on the northern boundary of Parcel One of the premises described in the deed from Bayroot LLC to Black Brook, LLC dated November 5, 2021 and recorded in the Franklin County Registry of Deeds in Book 4393, Page 91 and which rebar is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 836,607 U.S. Survey Feet and an Easting of 2,793,257 U.S. Survey Feet;

Thence along the north line of said land of Black Brook, LLC turning westerly, southwesterly and southerly following said northern bound of said Parcel One (33' southerly of and parallel to the centerline of the traveled way of Lincoln Pond Road) 12,730 feet, more or less, to a point in the west townline of Stetsontown Township (T3, R4 WBKP)

thence along the west townline of said Stetsontown (T3, R4 WBKP) and the east townline of Upper Cupsuptic Township (T4, R4 WBKP) North 07° 57' West a distance of 67 feet, more or less to a wooden post (labeled Pt. S.1 on Tract 1 Survey), which post is located with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 826,400 U.S. Survey Feet and an Easting of 2,789,780 U.S. Survey Feet;

thence along the west townline of said Stetsontown (T3, R4 WBKP) and the east townline of Upper Cupsuptic Township (T4, R4 WBKP) North 07° 57' West a distance of 33,635 feet, more or less, to a point at the intersection of two blazed lines, which point was observed with a hand held GPS in January of 2023



with reference to the Maine Coordinate System of 1983, West Zone, with a Northing of 859,710 U.S. Survey Feet and an Easting of 2,785,130 U.S. Survey Feet;

thence along the north line of said Stetsontown and the south townline of Seven Ponds Township (T3, R5 WBKP) North 80° 59' East a distance of 10,375 feet, more or less, to the true POINT OF BEGINNING, enclosing 5,096 acres, more or less.

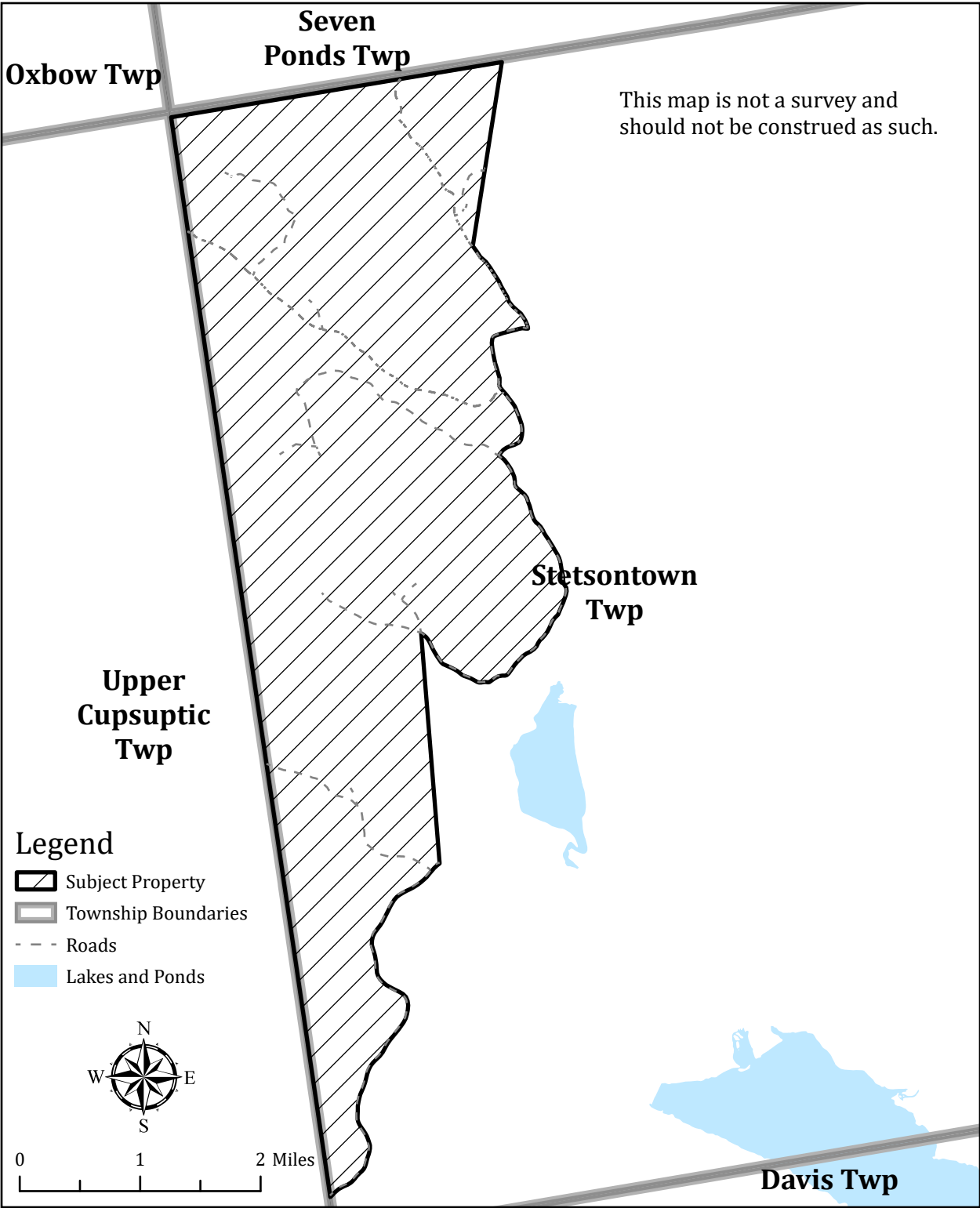
Iron rods set are three-quarter inch reinforcing rods with a cap marked "Plisga & Day PLS 2327".

Bearings referenced herein are oriented to Grid North referencing the Maine Coordinate System of 1983, West Zone, NAD83\_2011, as determined by a survey prepared by Plisga & Day, Land Surveyors dated January 7, 2022 (reference project number: 21396). Coordinate values identifying the point of beginning and other points are provided as an aid in location of the property and are not intended to control bearings, distances or the positions marked by monuments defining the property boundaries. Distances listed above reference grid distances, being measured with GPS using a ground to grid scale factor of 0.999896585.

The above premises include all of Landowner's right, title and interest in and to (i) the Lincoln Pond Road along the southerly boundary of the Protected Property, subject to those rights and easements reserved by Bayroot LLC in deed of Bayroot LLC to Rangeley Lakes Heritage Trust, Inc. dated on even or near-even date herewith, and (ii) the Sol Brook Road, the West Wiggle Road, the Wiggle Connector Road, the Wiggle Brook Road and the Bear Brook Road along the southerly and easterly boundaries of the Protected Property.

Together with and subject to all rights, easements and other matters of record, including, without limitation, those set forth in the RLHT Deed.

**Exhibit B. Property Depiction Stetsontown - Kennebago CE**



**MULTI-RESOURCE MANAGEMENT PLAN**  
**KENNEBAGO HEADWATERS CONSERVATION EASEMENT**

This Multi-Resource Management Plan (as the same may be amended from time to time, as so amended, “MRMP”), dated as of October 17, 2023 is entered into by **RANGELEY LAKES HERITAGE TRUST, INC.**, with a place of business in RANGELEY, MAINE, (hereinafter referred to as “Landowner”, which is intended to include unless the context clearly indicates otherwise, the above-named Landowner and its successors and/or assigns, and/or any future owners or successors-in-interest to the Protected Property or any portion thereof), the **FOREST SOCIETY OF MAINE**, (“Holder”), which is intended to include its successors and/or assigns).

This Multi-Resource Management Plan is being entered into pursuant to Section 4.6. and 4.7. of that certain conservation easement known as the Kennebago Headwaters Conservation Easement (as the same may be amended from time to time, as so amended, the “Conservation Easement”) granted by RANGELEY LAKES HERITAGE TRUST to Holder on October 17, 2023.

This MRMP applies to the Protected Property as that term is defined in the Conservation Easement.

**I. DEFINITIONS**

Unless defined herein, terms used in this MRMP that are defined in the Conservation Easement shall have the defined meanings as set forth in the Conservation Easement.

**Exemplary Natural Communities and Ecosystems:** Plant communities identified and defined by MNAP as common types, with a State rarity rank of S4 and S5, that are exemplary because of their size, condition and landscape context (element occurrence ranks of A or B).

**High Priority Vernal Pools:** Vernal pools hosting breeding evidence by: a) two or more indicator species (evidence may include: mating adults, spermatophores [salamander sperm packets], egg masses, or larvae), or b) > 20 egg masses of one of the indicator species.

**Late-Successional Condition:** Forest stands that are dominated by long-lived species, including sugar maple, American beech, yellow birch, red spruce, white pine and/or Eastern hemlock generally having at least 18 live or standing dead trees per acre that are at least 16" DBH. In areas above 2,000 feet in elevation or where soils limit diameter growth, such as on poorly drained, excessively drained, or shallow-to-bedrock sites the age of dominant and co-dominant canopy trees of over 150 years or the presence of recognized indicator lichen species may be used to indicate reaching this condition.



**MDIFW:** The state agency that is known as the Maine Department of Inland Fisheries and Wildlife, or any successor state department, agency, or bureau thereto that performs similar public functions.

**MDIFW Mapped Feature:** A point or polygon feature in the MDIFW database depicting a known Endangered, Threatened, or Special Concern wildlife species habitat that has been surveyed in the field or mapped at a sufficient scale to reasonably identify boundaries of the feature and does not include a buffer. Historic features are excluded from this definition.

**MNAP:** The state program that is known as the Maine Natural Areas Program, and is a part of the Maine Department of Conservation, or any successor state program or bureau thereto that performs similar public functions.

**MNAP Mapped Feature:** A point or polygon feature in the MNAP Biotics database depicting a known Rare, Threatened, and Endangered Plant, Rare Natural Community and Ecosystem, or Exemplary Natural Community and Ecosystem that has been surveyed in the field or mapped at a sufficient scale to reasonably identify boundaries of the feature and does not include a buffer. Historic features are excluded from this definition.

**Rare, Threatened, and Endangered Plants:** Plant species that are listed as Endangered, Threatened, or Special Concern with a State rarity rank of S1, S2 or S3.

**Rare Natural Communities and Ecosystems:** Plant communities identified and defined by MNAP as being rare, with a State rarity rank of S1, S2 or S3.

**Site Assessment:** Means visiting an area planned for forest management or other activities that would disturb the soils, during a time of year appropriate to adequately assess the site for the conditions referred to in this MRMP, consistent with the ability to make such findings (such as when ground conditions are snow-free).

**Stream:** Means either a perennial stream, which has flowing water year-round during a typical year, where the water table is located above the stream bed for most of the year, and groundwater is the primary source of water for stream flow; or an intermittent stream, which is a stream that has flowing water during certain times of the year, when groundwater provides water for stream flow, but during dry periods, intermittent streams may not have flowing water. Stream does not mean a ditch or other drainage way constructed, or constructed and maintained, solely for the purpose of draining storm water or a grassy swale.

## II. PURPOSE AND GENERAL REQUIREMENTS

### A. Compliance with Terms and Laws

Pursuant to Section 4.6. of the Conservation Easement, the purpose of the Multi-Resource Management Plan (MRMP) is to guide Forest Management Activities so as to be in compliance with the terms and conditions of the Conservation Easement. The Multi-Resource Management Plan has been crafted to both protect the Conservation Values of the Protected Property and allow its continued operation as a working forest in accordance with the terms and conditions of the Conservation Easement. All Forest Management Activities, except timber cruising and resource evaluation, shall be conducted in accordance with the MRMP. This MRMP shall remain in effect until amended or modified by the Parties, pursuant to Section V of this MRMP.

Unless otherwise specified herein, Landowner is hereby responsible and liable for the compliance of Landowner's employees, agents, contractors, and designees with the standards, policies, programs, practices and agreements set forth in this MRMP, when said parties are engaged in Forest Management Activities and other actions covered by the requirements of this MRMP in the capacity of employees, agents, contractors and designees for Landowner.

### B. Supervision of Forest Management Activities

All Forest Management Activities occurring on the Protected Property shall be supervised by a licensed professional forester and conducted under written contracts with competent operators, which contracts shall specify relevant requirements for compliance with this Conservation Easement and the Multi-Resource Management Plan.

## III. STANDARDS AND OBJECTIVES

### A. Wildlife Habitats

#### 1. Management Objectives

- a. To conserve the ecological values of the occurrences and habitats as documented on the Protected Property;
- b. To employ standards that are operationally feasible and practical to implement; and
- c. To allow for collaborative modifications based on science and site-specific needs.

#### 2. Rare, Threatened, Endangered, and Special Concern Wildlife Species

Landowner shall conduct all its Forest Management Activities in a manner consistent with the following standards for all known MDIFW Mapped Features and those identified in the future:

- a. Landowner shall maintain, and update at least annually, a database of MDIFW Mapped Features documented on the Protected Property. When modified or

*TO BE EXECUTED PRIOR TO CLOSING*

updated MDIFW Mapped Features are provided by MDIFW to the Landowner, these shall be incorporated into Landowner's Forest Management and operations plans in a timely manner;

- b. Landowner shall request a management consultation with MDIFW prior to conducting Forest Management Activities within one-quarter mile of MDIFW Mapped Features;
- c. Landowner shall consult with MDIFW and request management recommendations, prior to Landowner's conduct of planned Forest Management Activities, and with sufficient advance notice to MDIFW, to allow MDIFW the reasonable opportunity, if it so chooses, to conduct field surveys to investigate or update whether MDIFW Mapped Feature will be impacted by the planned Forest Management Activity. Prior to conducting any Forest Management Activities within the MDIFW Mapped Features, the Landowner shall notify MDIFW, and allow for a site visit by MDIFW, if MDIFW deems said consultation or site visit necessary;
- d. In the absence of a consultation with MDIFW, lack of an existing management standard, or timely management recommendations, the minimum standard shall be no Forest Management Activities may occur within one-quarter mile of the MDIFW Mapped Feature;
- e. Modifications to standards required at a specific MDIFW Mapped Feature shall occur through collaborative discussions and consensus between MDIFW and the Landowner in order to implement the desired conservation outcome based on scientific considerations or site-specific conditions; and
- f. For both known MDIFW Mapped Features and those documented in the future, Landowner acknowledges that the management goal is to conserve the ecological value of the MDIFW Mapped Features by maintaining or improving the occurrence rank. The Parties acknowledge that in many cases, timber harvesting can be accomplished in a manner that is compatible with this goal, as long as retained structures or patches effectively conserve and represent the conservation value originally identified. If MDIFW determines that at a specific site this management goal can be met and MDIFW Mapped Features conserved while changing certain performance standards, Landowner may utilize these alternative MDIFW performance standards at specific sites.

3. Inland Waterfowl and Wading Bird Habitats (IWWH)

Landowner shall conduct all its Forest Management Activities in a manner consistent with the following standards for all mapped IWWH and those identified in the future:

- a. Landowner shall maintain, and update at least annually, a database of MDIFW Mapped IWWH Features documented on the Protected Property. When modified or updated MDIFW Mapped IWWH Features are provided to the Landowner,



*TO BE EXECUTED PRIOR TO CLOSING*

these shall be incorporated into Landowner's Forest Management and operations plans in a timely manner;

- b. 330-foot buffer zone around the perimeter of the IWWH Mapped Feature with the following treatment:
  - i. 0 to 100 feet: no Forest Management Activities;
  - ii. 100 to 330 feet: Forest Management Activities may occur so long as the resulting stand conditions retain approximately 60% crown closure and residual trees are uniformly distributed throughout this portion of the buffer zone.

4. Vernal Pools

Landowner shall conduct all its Forest Management Activities in a manner consistent with the following standards for all mapped vernal pools and those identified in the future, however due to the small size of some vernal pools and the difficulties associated with dry season identification, it is recognized that vernal pools may be misidentified occasionally or not encountered during Forest Management Activity planning:

- a. In order to minimize adverse impacts of Forest Management Activities on this resource, a Site Assessment of the forest conditions for potential vernal pools must be completed;
- b. *Unverified high priority vernal pools*  
Shall be presumed to exist where one or more of the following features are found during the following seasons:

- i. *Identification during the dry season:*

Physical characteristics of the forest floor that provide evidence of sustained temporary flooding including a topographic depression with the presence of compacted leaves darkened by water stains or a film of sediment, water stains, wetland plants, and/or the shells of fingernail clams, aquatic snails, and/or casts of aquatic insects.

- ii. *Identification during Spring or wet season:*

Small wetlands with a minimum size of 625 square feet, with no permanent flowing inlet or outlet, holding at least 12 inches of water at spring maximum and containing water until June 30 based on typical annual precipitation; or

Evidence of the presence of one or more of (a) Maine's vernal pool amphibian indicator species (e.g., eggs, larvae or adults if wood frogs or spotted or blue spotted salamanders), (b) fairy shrimp, and/or (c) rare, threatened, or endangered species (e.g., Blanding's or Spotted turtles, featherfoil).

- iii. *Habitat Management for Unverified High Priority Vernal Pools:*

These guidelines shall be applied to vernal pools that have not been verified as High Priority as defined in this document in order to minimize potential adverse

## TO BE EXECUTED PRIOR TO CLOSING

impacts to this resource.

- a. Forest Management Activities shall be prohibited within a 400-foot buffer zone of the vernal pool depression;
- b. Prior to Forest Management Activities occurring within the 400-foot buffer zone, a survey of the pool habitat during the appropriate season must occur by a qualified individual with demonstrated expertise in such documentation in Maine;
- c. If the pool is determined as a Verified high priority vernal pool, following an appropriate survey, then the standards listed below apply; and
- d. If the pool is determined to be a non-priority pool, following an appropriate survey, no vernal pool guidelines need be applied.

### c. *Verified high priority vernal pools*

Are those mapped and documented by a state agency or by an individual with demonstrated expertise in such documentation in Maine:

- i. Habitat management shall be based on the *Forestry Habitat Management Guidelines for Vernal Pool Wildlife* (Calhoun and deMaynadier 2004), and
- ii. Vernal Pool clusters, defined as three or more pools within 600 feet of each other, should comply with the Habitat Management Guidelines and should be considered as a vernal pool ecosystem complex regardless of egg mass numbers; and
- iii. Vernal pools shall be identified in the field prior to forest management activities, so that activities can be appropriately guided to minimize adverse impacts.

### d. *Training*

Foresters or other professionals shall receive periodic training which will provide information on identifying vernal pools, their functions, and conservation importance.

## 5. Watershed Management Areas

The streams and their associated wetlands and riparian areas serve an important ecological function in the context of the forested landscape. To ensure those values continue, the Landowner shall conduct all its Forest Management Activities in a manner consistent with the following standards, which are also generally depicted on Map 1. (regardless of mapped representations of stream and other wetland feature locations, conditions on the ground will be used to determine their locations and extents):

- a. Forest Management Activities
  - i. In order to maintain overall watershed health and function, no more than 20% of the forested area on the Protected Property in any

*TO BE EXECUTED PRIOR TO CLOSING*

- watershed (USGS HUC12 classification) may have stand conditions where the average age of the dominant canopy is under 10 years old;
- ii. In order to minimize adverse impacts of Forest Management Activities on streams (as defined in this plan), wetlands, ephemeral flow areas, and other water bodies, and in order to successfully implement these standards, a Site Assessment of the forest conditions for these features must be completed;
  - iii. Forest Management Activities, including any road or trail building, regardless of primary use, occurring within and adjacent to streams, wetlands, ephemeral flow areas, and other water bodies, shall be implemented in accordance with the Maine Forest Service's Best Management Practices for Forestry (2017), in order to minimize adverse effects on soils and water quality;
  - iv. In order to enhance the stream habitats within watersheds, certain vegetation and stream manipulation activities are allowed and are not subject to the following standards as long as such activities are implemented as part of a discrete plan which is subject to all relevant regulatory requirements and MDIFW Regional Biologist prior approval; and
  - v. In those areas where there is reference to buffers below, the buffers shall be measured outward from the upland most boundary of the normal stream bank, evidence of seasonal high water (for example, floodplain debris) or the associated non-forested wetland with which the stream is associated.
- b. Riparian Habitat Management of Streams
- i. Riparian Management Buffer
    - 1. No Forest Management Activities may be implemented within the following defined buffers:
      - a. Streams located in areas with slopes up to 10% shall have a buffer of 100 feet on both sides of stream; and
      - b. Streams located in areas with slopes greater than 10% shall have a buffer of 250 feet on both sides of the stream.
  - ii. Riparian Management Area
    - 1. Defined as the area from the Riparian Management Buffer outward to 330 feet from the stream;
    - 2. Forest Management Activities are allowed subject to the following prescription: the resulting stand conditions retain approximately 60% crown closure and residual trees are uniformly distributed throughout this portion of the buffer zone.
    - 3. Forest Management Activities occurring within this Area shall be implemented subject to the Maine Forest Service's Best Management Practices for Forestry (2017).



iii. Stream Crossings

1. It shall be the goal of the Landowner to minimize stream crossings;
2. There shall be no stream crossings on streams located on slopes greater than 10%; and
3. In the event that a road or trail is maintained, repaired, upgraded, used, or constructed and that road crosses a stream, the crossing shall be constructed and managed following Stream Smart Standards as outlined in the Maine Forest Service's Best Management Practices for Forestry (2017).

**B. Rare, Threatened and Endangered Plants; Rare Natural Communities and Ecosystems; Exemplary Natural Communities and Ecosystems**

Landowner shall conduct all its Forest Management Activities in a manner consistent with the following standards:

1. Management Objectives

- a. To conserve the ecological values of Rare, Threatened, and Endangered Plants, Rare Natural Communities and Ecosystems, and Exemplary Natural Communities and Ecosystems;
- b. To employ standards that are operationally feasible and practical to implement; and
- c. To allow for collaborative modifications based on science and site-specific needs.

2. Management Standards

- a. Regarding all known MNAP Mapped Features and those identified in the future:
  - i. Landowner shall maintain, and update at least annually, a database of MNAP Mapped Features. When modified or updated MNAP Mapped Features are provided by MNAP to the Landowner, these shall be incorporated into Landowner's Forest Management and operations plans in a timely manner;
  - ii. Landowner shall consult with MNAP prior to Landowner's conduct of planned Forest Management Activities, and with sufficient advance notice to MNAP, to allow MNAP the reasonable opportunity, if it so chooses, to conduct field surveys to investigate or update whether MNAP Mapped Feature or associated buffers will be impacted by the planned Forest Management Activity. Prior to conducting any Forest Management Activities within the MNAP Mapped Features or associated buffers, the Landowner shall notify MNAP, and allow for a site visit by MNAP, if MNAP deems said consultation or site visit necessary;
  - iii. Modifications to performance standards required at a specific MNAP Mapped Feature can occur through collaborative discussions and

consensus between MNAP and the Landowner in order to implement the desired conservation outcome based on scientific considerations or site-specific conditions;

- iv. For both known MNAP Mapped Features and those documented in the future, Landowner acknowledges that the management goal is to conserve the ecological value of the MNAP Mapped Features by maintaining or improving the occurrence rank. The Parties acknowledge that in many cases, timber harvesting can be accomplished in a manner that is compatible with this goal, as long as retained structures or patches effectively conserve and represent the conservation value originally identified. If MNAP determines that at a specific site this management goal can be met and MNAP Mapped Features conserved while changing certain performance standards, Landowner may utilize these alternative MNAP performance standards at specific sites.

3. Implementation Standards for Rare, Threatened, and Endangered Plants

- a. 250 foot buffer zone around the perimeter of the MNAP Mapped Feature with the following treatment:
  - i. 0 to 100 feet: no Forest Management Activities;
  - ii. 100 to 250 feet: no more than 40% volume removal within a 10-year period and which retains a well distributed forest.
- b. In wetlands: Ground disturbing Forest Management Activities within the MNAP Mapped Feature and buffer zone shall be implemented only on frozen or dry ground conditions that avoids or minimizes potential erosion and sedimentation of the aquatic feature.

4. Implementation Standards for Rare and Exemplary Natural Communities and Ecosystems

- a. Wetland Natural Communities and Ecosystems:
  - i. No Forest Management Activities within the MNAP Mapped Feature.
  - ii. 250 foot buffer zone around the perimeter of the MNAP Mapped Feature with the following treatment:
    - 1. 0 to 100 feet: no Forest Management Activities;
    - 2. 100 to 250 feet: no more than 40% volume removal within a 10-year period and which retains a well distributed forest;
    - 3. Ground disturbing Forest Management Activities within the buffer zone shall be implemented only on frozen or dry ground conditions that avoids or minimizes potential erosion and sedimentation of the aquatic feature.
- b. Upland Natural Communities and Ecosystems:
  - i. Site-specific management plans that shall be created in consultation with MNAP prior to any Forest Management Activities being implemented;
  - ii. These site-specific management plans shall include a map and description of the ecological resource, the allowed Forest Management Activities, and a description of how the ecological value will be conserved.

### **C. Late-Successional Forest Management Area**

Landowner shall conduct Forest Management Activities within the Late-Successional Forest Management Area (LSFMA) shown on Map 1. in a manner that conserves and encourages the development of late-successional forest habitats.

#### **1. Management Objectives**

- a. By the year 2125, if not earlier, at least 60% of the LSFMA will be in a late-successional condition, as defined in this plan; and
- b. The manner in which this is accomplished shall be in conjunction with the other standards outlined in this MRMP, the conservation easement, and through the development and implementation of a long-term Late-Successional Forest Management Plan (LSFMP) that outlines the specific actions to be taken within the LSFMA.

#### **2. Management Standards**

- a. No Forest Management Activities may occur within the LSFMA until the first LSFMP has been developed;
- b. Permanent reserves where Forest Management Activities are prohibited, shall be mapped, concentrated on Sol Ridge and the eastern “flank” of Snow Mountain, as identified on Map 1.;
- c. Following its initial development, the LSFMP shall be updated on the same schedule as the Forest Management Plan for the entire Protected Property (no less often than every 10 years). The LSFMP shall include the following:
  1. A description of the current conditions of the stands within the LSFMA;
  2. A description of silvicultural techniques to be implemented to promote the long-term desired conditions;
  3. A methodology to assess growth to harvest ratios (which may change over time as stands mature);
  4. A species retention and marking guide;
  5. A description of the anticipated timeline of forest management activities for the stands outside of the permanent reserves;
- d. Once reached, at least 60% of the LSFMA remain in a late successional condition at all times; and
- e. Conduct Late-Successional Index assessments to track progress toward the Late Successional Index goal at intervals of no less than 20 years, the first of which shall take place 20 years from the date of the easement.



#### **D. Invasive Plant Management**

Invasive plants are non-native plants that can threaten aquatic and terrestrial ecological integrity. While many invasive plants could become problematic in the Kennebago watershed, at this time Japanese knotweed (*Reynoutria japonica*, synonyms *Fallopia japonica* and *Polygonum cuspidatum*) and common reed (*Phragmites australis*) present the greatest near-term threats to the watershed.

##### **1. Management Objectives**

To minimize the risk from invasive plants the landowner shall develop and implement an invasive plants program that at a minimum includes the following standards.

##### **2. Management Standards**

- a. When coming from off the Protected Property to perform work on the Protected Property, Landowner's contractors are required to power-wash all equipment to remove soil, seeds, and other plant materials prior to bringing equipment onto the Protected Property;
- b. Materials brought onto the Protected Property, for use there, such as gravel, soils, mulch, and seed mixes for erosion control or wildlife habitat improvement come from sources that are free of invasive plants;
- c. Road systems, areas of soils disturbance, wetlands and stream courses are monitored on a regular basis for the presence of invasive plants;
- d. If, and when detected, the Landowner shall develop a plan and take appropriate steps to control, and eradicate if feasible, invasive plants according to all laws and best management practices related to such activities; and
- e. Follow all other best management practices to minimize the introduction of invasive plants on the Protected Property.

#### **IV. DATA**

The Landowner shall maintain and update data (GIS, maps, reports, survey results, etc.) in digital and other forms, as appropriate, of existing and new occurrences of features and management areas referenced in and subject to this MRMP in order to successfully implement the provisions of this MRMP. Additionally, the Parties shall share updated information, including where and how the data was collected with each other annually at the annual meeting. The Landowner shall also develop and implement a schedule to request a review of data held by state and other resources agencies for occurrences on the Protected Property.

**V. AMENDMENT, NOTICES**

The Parties expect that the standards set forth herein and other actions required in this Multi-Resource Management Plan may require amending from time to time, based upon the results of audits, research, or other advances in knowledge and understanding of the regional forest habitats. No such amendment may be any less protective of the Conservation Values than the standards in effect prior to any such amendment, unless additionally agreed to by the state resource agency primarily responsible for mapping and managing said resource. The MRMP shall remain in effect until amended or modified by the Parties, at which time the amended or modified form of the MRMP shall remain in effect. No amendment to this MRMP may become effective until agreed to by Landowner and Holder, which shall be demonstrated by a written agreement with the new terms. Holder will keep an accurate copy of the current MRMP in their files and will make the current MRMP available to successors in interest to the Protected Property or any portion thereof. Notices hereunder shall be given as specified in the Conservation Easement. The terms of this MRMP shall transfer to future owners in the case of a transfer of the Protected Property.

**VI. REQUIREMENT TO COMPLY WITH LAWS AND REGULATIONS**

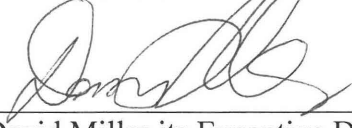
Nothing in this Multi-Resource Management Plan is intended to supersede, eliminate, or otherwise change any obligation of the Landowner under any applicable law, including but not limited to the obligation to obtain any and all required regulatory approvals for activities permitted under the terms of this MRMP. Nothing herein may be construed as approval of or as a substitute for approval or regulation of any activities under the regulatory jurisdiction of the Land Use Planning Commission (LUPC, or successor agency), Maine Forest Service (MFS) or other State, or Federal regulatory bodies. Nothing in this MRMP may be construed to permit an activity otherwise prohibited or restricted by state, local, or federal laws or regulations, with which Landowner shall have a responsibility to comply.

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TO BE EXECUTED PRIOR TO CLOSING

LANDOWNER:

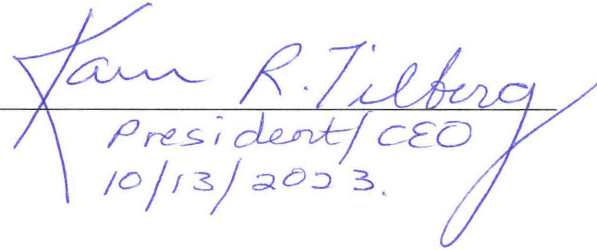
**RANGELEY LAKES HERITAGE TRUST, INC.**

By:   
David Miller its Executive Director

Date: October 13, 2023

HOLDER:

**FOREST SOCIETY OF MAINE**

By:   
Its: President/CEO  
Date: 10/13/2023.



# Stetson - Kennebago CE Multi-Resource Management Plan

## Map 1. Resource Values and Management Zones

