Focus Species Forestry

A Guide to Integrating Timber and Biodiversity Management in Maine

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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, 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.

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.

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.

Umbrella Species Effect of Managing for American Marten in Northern Maine	
Species Group	**Number of Species[1]**
Reptiles	3 (100%)
Amphibians	8 (50%)
Mammals	40 (80%)
Birds	80 (70%)
Plants	Hundreds?
Fungi	Hundreds?
Insects	Thousands?

[1] Estimate based on DeGraaf and Yamasaki 2001, Gawler et al. 1996; percent based on non-aquatic, forest-dependent species.

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.

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[1];
- **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: 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

[1] 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.

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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[1].
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[1].
Late spring-early summer	✓ Listen for songbirds defending their territory in early morning and the flute-like calls of thrushes at dusk[2]. ✓ Beware of nesting goshawks. ✓ Go fishing for brook trout.
Spring or summer	✓ Look for stream salamanders under rocks along at the edge of intermittent streams. ✓ 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.

[1]Maine Audubon has monitoring protocols for owls and vernal pools.
[2]“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

Focus Species Habitat Classification	Brief Description (See habitat management guides in Section 5 for more detailed descriptions.)
Forest Ecosystems	
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
Special-value Habitats	
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[1]	**Description**
Early Successional	Regeneration and Seedlings	Less than 30 sq.ft. basal area/ac. (BA) in trees >1 in. dbh. 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. 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: • Softwood stands: >5 in. • Hardwood stands >5 in. 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 • Spruce-fir >9 in. • Hardwoods >12 in. • Pine-hemlock >12 in. 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): • Spruce-fir ≥12 in. • Hardwoods ≥16 in. • Pine-hemlock ≥20 in. • Large deadwood accumulating • Indicator species (e.g., certain lichens) present 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.

[1] 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[2].

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.

[2] "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[1] Ruffed grouse Chestnut-sided warbler	Northern goshawk Ruffed grouse

[1]Conifer understory present

Focus Species Management	
Overview	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.
Single-tree and Group Selection	✓ Avoid single-tree selection if the goal is to maintain aspen-birch. ✓ Large-group selection will sustain these species, but there will be an increasing component of more shade-tolerant species over time.
Shelterwood, Small Patch Cuts, and Clearcuts	✓ 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.
Other	✓ 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. ✓ Soil scarification is important for birch regeneration. ✓ Older declining aspen clones may not sprout well. ✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level recommendations (Section 7). ✓ 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. ✓ Try to maintain aspen inclusions in other forest types near riparian areas where beaver may be present.

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 Snowshoe hare[1] Ruffed grouse	Fisher (South region) American marten (North region) Northern goshawk Pileated woodpecker Barred owl Wood thrush (South region) Black-throated-blue warbler Redback salamander	Lungwort lichen *(Lobaria pulmonaria)*

[1]conifer understory present

Focus Species Management	
Overview	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.
Single Tree Selection	✓ Well suited to maintaining mature forest and consistent with natural disturbance patterns. ✓ May be used with caution in maple-basswood-ash forest (a rare natural community)—avoid soil disturbance and maintain >60% overstory canopy closure.
Group Selection	✓ 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.
Shelterwood and Clearcut	✓ Use to create patches of early successional habitat over 2 acres in size and to regenerate intolerant species or low-quality stands. ✓ Retain patches of mature stands in islands or peninsulas as well as travel corridors. See stand-level guidelines for details (Section 7). ✓ Return tree tops to the harvest area to prevent nutrient depletion and maintain soil structure. ✓ Shelterwood harvests can be used to emulate extreme natural disturbances; lengthening the period before overstory removal will minimize impacts to herbaceous plants. ✓ Clearcuts have no true natural analogue and require a longer time for ecosystem recovery. ✓ When clearcuts and shelterwood are used, long rotations (>100 years) may be necessary to restore mature forest conditions.
Other	✓ 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. ✓ Maintain inclusions of hemlock, spruce, and other conifers. ✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7). ✓ Refer to landscape-level guidelines for recommendations on integrating landscape structure and design into stand level-decisions (Section 8).

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 Chestnut-sided warbler Eastern towhee	Fisher Northern goshawk Pileated woodpecker Barred owl Wood thrush Pine warbler Redback salamander	No species currently known due to limited research

Focus Species Management	
Overview	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.
Single-tree and Group Selection	✓ Light single-tree selection is unlikely to maintain oak-pine except on very dry sites. ✓ 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.
Shelterwood, Small Patch Cuts, and Clearcuts	✓ 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. ✓ 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.
Other	✓ Maintain and encourage oak mast trees for bear, deer, turkey, squirrels, and mice. ✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7). ✓ Refer to landscape-level guidelines (Section 8). ✓ 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.

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) Fisher (South region) White-tailed deer (North region) Pileated woodpecker Barred owl Wood thrush Redback salamander	No species currently known due to limited research

Eastern Hemlock

Focus Species Management	
Overview	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.
Single-tree and Group Selection	✓ Both approaches are well suited to maintaining mature forest conditions and are consistent with natural disturbance patterns. ✓ Small-group selection (0.1 acre or less) can be to used to regenerate hemlock while creating within-stand patchiness.
Shelterwood and Clearcut	✓ Researchers recommend a 2- or 3-stage shelterwood with 70-80% canopy cover with scattered gaps. ✓ If the shelterwood system is used, be sure to retain the overstory in a two-aged system or maintain mature hemlock cover nearby. ✓ Clearcutting is not recommended in hemlock forests.
Other	✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7). ✓ 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. ✓ Refer to landscape-level guidelines (Section 8). Use hemlock stands to help build and maintain mature and late-successional components of the landscape.

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 Bicknell's thrush (limited to fir-heartleaved birch subalpine forest) 9 rare plants
Rare Natural Communities
Fir-heartleaved birch subalpine forest

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

Focus Species Management	
Overview	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.
Single-tree and Group Selection	✓ 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.
Shelterwood, Patch Cuts, and Clearcut	✓ 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. ✓ 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. ✓ 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).
Other	✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7). ✓ 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. ✓ See guide to landscape-scale forestry (Section 8) and guidelines for American marten (Section 6). ✓ In northwestern Maine where lynx may be found, check with the Maine Department of Inland Fisheries and Wildlife (MDIFW). ✓ In northern and eastern Maine, work with MDIFW to develop a long-term plan for managing deer wintering areas.

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 White-tailed deer (North region) Black-backed woodpecker (North region)	No species currently known due to limited research

Focus Species Management	
Overview	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.
Single-tree and Group Selection	✓ Single-tree and small-group selection are best for maintaining cedar and associated plant and wildlife habitat.
Shelterwood, Small Patch Cuts, and Clearcuts	✓ 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. ✓ Patch cuts may release advanced regeneration and provide good browse but will be more harmful to any rare plants that may be present.
Other	✓ 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. ✓ 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. ✓ Follow recommendations for snags, cavity trees, and downed woody material and other stand-level guidelines (Section 7). ✓ 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.

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 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[1]
Beaver Pileated woodpecker Northern waterthrush Wood turtle Northern dusky salamander Brook trout

[1] Focus species vary with water body type. See management table on following page.

Riparian and Wetland Forest

<table>
<tr><th colspan="3">Focus Species Management</th></tr>
<tr><th>Water Body</th><th>Width (ft.)</th><th>Focus Species/
Primary Management Goals</th></tr>
<tr><td>Seeps, intermittent streams</td><td>≤75</td><td>Focus Species: Northern dusky salamander
Management Goals:
• Protect water quality by avoiding soil disturbance and sediment runoff.
• Maintain shade along stream channel.</td></tr>
<tr><td>Small- to medium-sized perennial streams (first- and second-order streams)[1]</td><td>75-250[2]</td><td>Focus Species: All
Management Goals:
• Protect water quality and maintain shade.
• Manage for large snags and cavity trees.</td></tr>
<tr><td>Large streams and rivers (third- and fourth-order steams)[1]</td><td>≥250</td><td rowspan="3">Focus Species:
Freshwater: All except dusky salamander
Coastal waters: Pileated woodpecker only
Management Goals:
• Protect water quality and maintain shade.
• Manage for large snags and cavity trees.
• Maintain large pines for eagle and osprey nest and roost trees adjacent to rivers, ponds >10 acres, and coastal waters.
• Buffers in excess of 75 ft. provide wildlife travel corridors and buffer aquatic wildlife from human activities in uplands.</td></tr>
<tr><td>Ponds and non-forested wetlands <10 acres</td><td>75-100</td></tr>
<tr><td>Ponds and non-forested wetlands >10 acres; coastal waters</td><td>≥250</td></tr>
<tr><td colspan="3">Recommendations:
✓ Always apply appropriate Best Management Practices (BMPs)[3] to control erosion and sediment.
✓ Modify timber management as needed to achieve riparian management goals (column 3).
✓ 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.
✓ 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.
✓ 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.
✓ 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.
✓ Flag seeps and intermittent streams before snowfall.
✓ Follow recommendations for snags, cavity trees, and downed woody debris (Section 7).
✓ State and local regulatory standards also apply.</td></tr>
</table>

[1] 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 innacurate; use site visits to identify small perennial and intermittent streams.

[2] Increase management zone width up to 250 ft. with increase in slope and decrease in soil permeability.

[3] *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 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

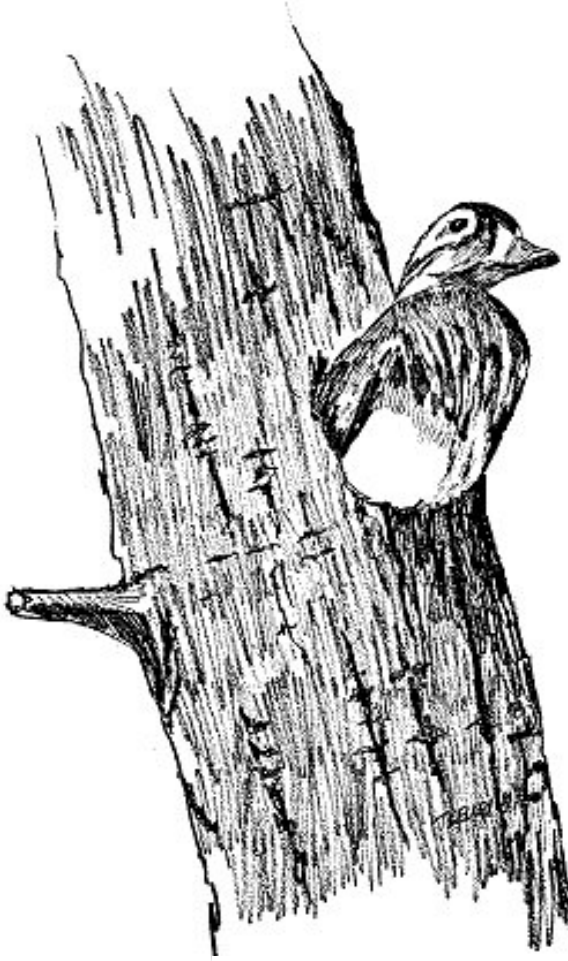
Rare Species
• Blanding's turtle (Maine threatened) and spotted turtle (Maine endangered) may be found in vernal pools in York and Cumberland counties • Four-toed salamander, ribbon snake, and wood turtle (all Maine special concern) may also be found in vernal pools statewide • Several rare plants are 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[1]		
Vernal Pool Depression	**Vernal Pool Protection Zone 0-100 ft.**	**Amphibian Life Zone 100-400 ft.**
✓ Identify and flag the pool boundary during the spring wet season or by using dry-season indicators. ✓ Do not disturb the pool depression with equipment, slash, or sediment.	✓ Maintain an average 75% canopy cover of trees over 20-30 ft. tall to protect young amphibians leaving the pool. ✓ Harvest in frozen or dry conditions to prevent rutting and protect habitat of soil-dwelling salamanders. ✓ Maintain abundant coarse woody debris used as feeding habitat and cover by amphibians.	✓ Maintain a minimum of 50% canopy cover of trees over 20-30 ft. tall and keep openings below one acre. ✓ Harvest in frozen or dry conditions to minimize soil disturbance. ✓ Maintain abundant coarse woody debris.

[1] 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



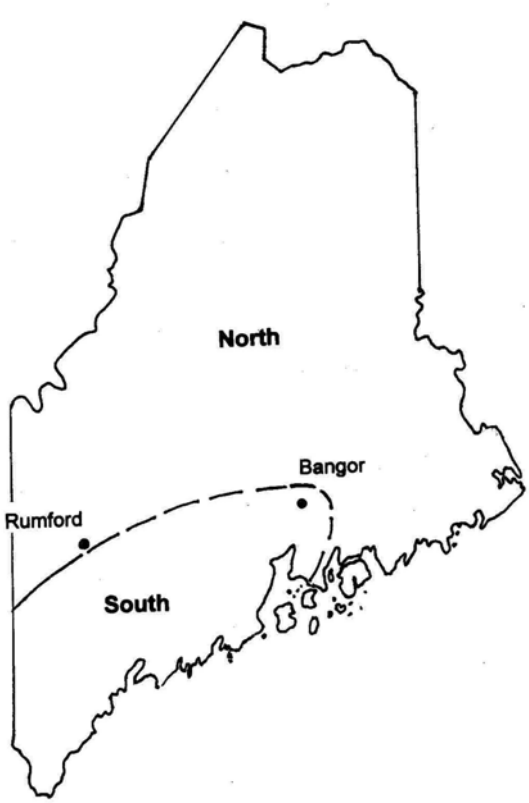
Wood Duck ***(U.S. Fish and Wildlife Service)***

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.

Figure 1. Focus Species Regions



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).

Habitat Use: The habitat-use chart[3] 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	
Mx	A coniferous component in hardwood forests or deciduous component in softwood forests is important
U	Identifies when a species requires understory saplings or shrubs
C	Requires or is strongly associated with snags or cavity trees

[3] 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
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, Jakubas and Cross 2001, Koeller and Bridell 1990, Krohn and Allen 1988, Williamson undated

Beaver

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
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: 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		

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, 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

Fisher

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		

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: 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
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, Foss 1999b, Hobson et al. 1993

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

Barred Owl

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	

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	

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, Rosenburg 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 Carribean. 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

Pine Warbler

Distribution: Southern Ontario and southwest Quebec, south to Texas and Florida

Maine Focus Region: Statewide

Territory: 1-3 acres, possibly larger with low pine density

Food: Adult and insect larvae, spiders

Special Habitat Needs: Stands with relatively mature to mature white pine or pitch pine

Management:

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

Comments: The irregular trill of the pine warbler may be heard high in the canopy during the spring breeding season from late April through July. The only vertebrate in our region that is dependent on pines, pine warbler density declines as the percent of hardwood increases in the canopy or the understory. White pines also make good roost trees for wild turkeys in oak-pine forests. Long-eared and northern saw-whet owls, red-breasted nuthatch, hermit thrush, solitary vireo and red squirrel may also be found in stands where pine warblers are 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	M,L	
										WP	WP	WP	WP					WP	WP	WP	WP				WP	

R	Regeneration and seedlings	Mx	Mixed conifer-deciduous		Focus habitat
S	Saplings and small poles	WP	White pine required		Other habitat
I	Intermediate-aged forest	U	Understory present		Little/no use
M	Mature forest	C	Cavity tree or snag		
L	Late-successional forest				

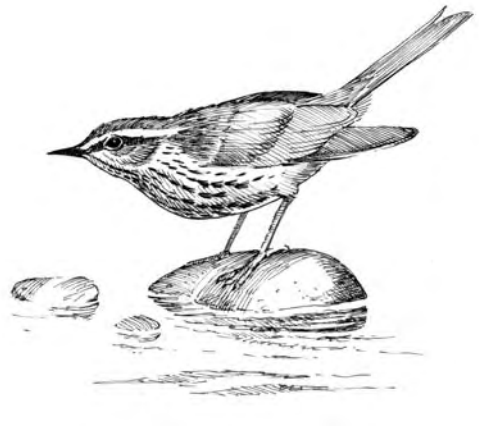
References: Boone and Krohn 1998, DeGraaf and Yamasaki 2001, Hagan et al. 1997, Sauer et al. 2003, Sibley 2000, Terres 1991, http://www.natureserve.org/explorer/

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
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

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

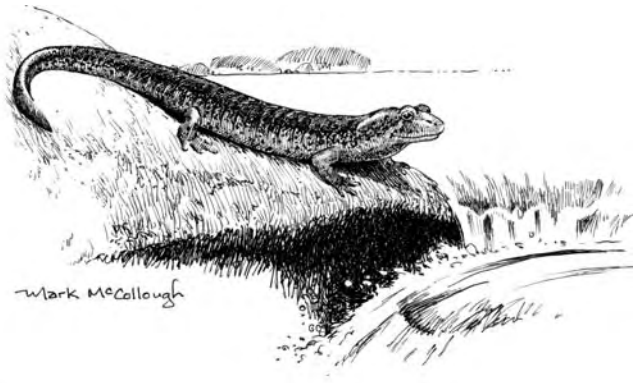
Mx Mixed conifer-deciduous
U Understory present
C Cavity tree or snag

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. Duskies 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
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: 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	I	M	L	R	S	I	M	L	I	M	L		

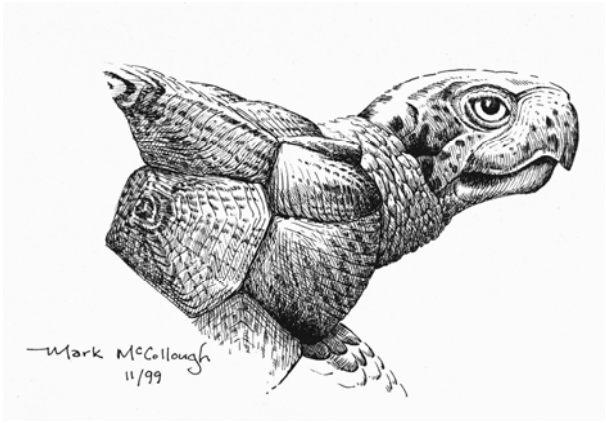
R Regeneration and seedlings
S Saplings and small poles
I Intermediate-aged forest
M Mature forest
L Late-successional forest
Mx Mixed conifer-deciduous
U Understory present
C Cavity tree or snag

Focus habitat
Other habitat
Little/no use

References: Boone and Krohn 1998, Calhoun 2003, Calhoun and deMaynadier 2003, DeGraaf and Yamasaki 2001, 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 steams 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		

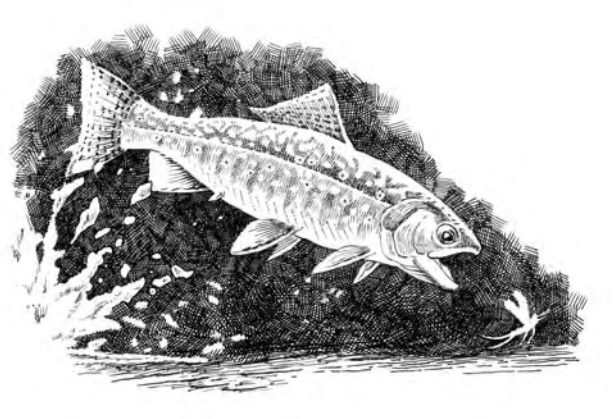
R Regeneration and seedlings
S Saplings and small poles
I Intermediate-aged forest
M Mature forest
L Late-successional forest
Mx Mixed conifer-deciduous
U Understory present
C Cavity tree or snag

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 65^0 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

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

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) 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	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
? More research needed

Focus habitat
Other habitat
Little/no use

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

Table 3. Focus Species Summary Table

Development Stage	Species and Region [1]	Primary Focus Species [2]	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
			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				
Early Succession	Snowshoe Hare	✓	■	■	Mx	Mx	■	■	Mx	Mx	Mx	Mx	Mx	Mx	Mx	Mx	U	U	U	■	■	U	U	U	U	U	U	Mx, U			
	Ruffed Grouse	✓	■	■	■	▒	■	■	■	▒	▒	■	■	■	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒			
	Chestnut-sided Warbler	✓	■	▒			■	▒				■	▒															▒			
	Eastern Towhee (S)												■	■	■	U															
	Magnolia Warbler						Mx	Mx	Mx	Mx	Mx						U	U	U	■	■	U	U	U				▒			
Mature	Fisher (S)	✓	▒	▒	▒	▒	▒	▒	■	■	▒	▒	▒	■	■	▒	■	■	▒	▒	▒	■	■	▒	▒	▒	▒	▒		X	X
	Marten (N)	✓			▒	▒	▒	▒	■	■	▒						■	■	▒	▒	▒	■	■	▒	■	■	▒	▒		X	X
	White-tailed Deer (N)		▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	■	■	▒	▒	▒	■	■	▒	■	■	▒	▒			
	Northern Goshawk	✓	▒	▒	▒	■	▒	▒	▒	■	▒	▒	▒	▒	■	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		X	
	Pileated Woodpecker	✓			▒	▒			▒	■	▒			▒	■	▒	▒	■	▒			▒	▒	▒	▒	▒	▒	■			X
	Black-backed Woodpecker (N)																					▒	■	▒	▒	■	▒	▒		?	X
	Barred Owl								▒	■	▒			▒	■	▒	▒	■	▒			▒	▒	▒	▒	▒	▒	▒		X	X
	Wood Thrush (S)			▒	▒	▒		▒	▒	■	▒		▒	▒	■	▒	▒	■	▒											X	
	Pine Warbler											WP	■	■	WP						WP	■	■	WP				WP			
	Black-throated Blue Warbler				U	U			■	■	U											Mx	Mx							X	
	Northern Redback Salamander			▒	▒	■		▒	▒	■	▒		▒	▒	■	▒	▒	■	▒		▒	▒	■	▒	▒	▒	▒	▒			
LS	Late-succesional Lichens	✓				▒				▒	■				▒	■		▒	■				▒	■		▒	■	▒			
Riparian & Wetland	Beaver																											■			
	Northern Waterthrush																								▒	▒	▒	■		X	
	Wood Turtle			▒	▒	▒		▒	▒	▒	▒		▒	▒	▒	▒	▒	▒	▒		▒	▒	▒	▒	▒	▒	▒	▒	■	X	
	Northern Dusky Salamander	✓																										■			
	Brook Trout	✓																										■			
VP	Wood Frog		▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	■		
	Spotted Salamander	✓			▒	▒			▒	▒	▒			▒	▒	▒	▒	▒	▒			▒	▒	▒	▒	▒	▒	▒	■		

Development Stage

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

Habitat Modifers

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

[1] Focus species region is statewide unless noted as S (south) or N (north)

[2] 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.

Andrea Sulzer

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 Snags, Cavity Trees, and Downed Woody Material		
Deadwood and Decay Component	**Trees and Logs Per Acre**	
	≥ 15 in.	**≥ 21 in.**
Snags	4	1
Snag and Cavity Recruitment Trees	4	1
Downed Woody Material	4	1

Number of Species Using 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.

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.

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

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

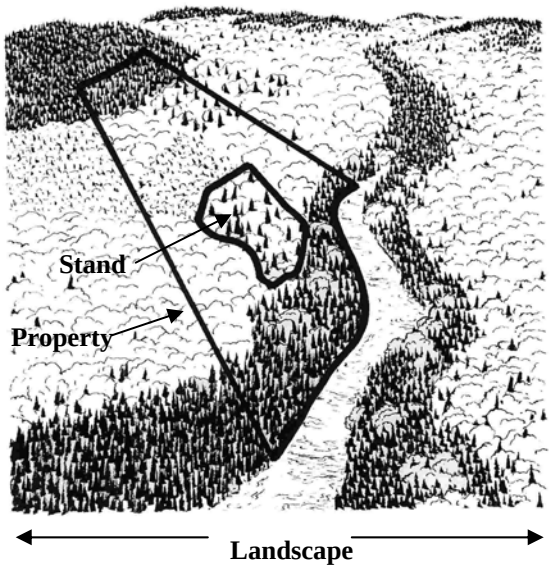
Landscape Planning Unit Size

- ✓ **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[1]	
Development Stage	**Landscape Goal**
Regeneration, Saplings and Small Poles	5-30%
Intermediate	Varies[2]
Mature	≥ 20%
Large-diameter mature stands (≥15 in. dbh) and Late Successional	≥ 10%

[1] Adapted from DeGraaf et al. 1992, Maine Council on Sustainable Forest Management 1996, and draft recommendations of the Maine Forest Service Biodiversity Advisory Committee.
[2] 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 interspersion 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.

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 interspersion 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.

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

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)
    - o 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.
    - o 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 an 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

- 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

Thrushes: *A land manager's guide to improving habitat for forest thrushes* by Rosenburg 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) Maple-basswood-ash forest (S3) Spruce-northern hardwoods forest (beech, yellow birch, and sugar maple > spruce and fir) (S4)
Oak-Pine	Oak-pine forest (S4) Red oak-northern hardwoods-white pine forest (S4) White oak-red oak forest (S2) Red-pine-white pine forest (S3) White pine-mixed conifer forest (hemlock co-dominant) (S4)
Hemlock	Hemlock forest (S4)
Spruce-Fir	Maritime spruce-fir forest (S4) Fir-heart-leaved birch subalpine forest (typically > 2700 ft.) (S2) Spruce-fir-wood sorrel-feather moss forest (montane, up to 2500 ft.) (S4) Spruce-fir-broom-moss forest (lower elevation) (S4) Spruce-fir-cinnamon fern forest (wetland) (S4) Spruce-northern hardwoods forest (spruce and fir > beech, yellow birch, and sugar maple) (S4) White pine-mixed conifer forest (red spruce co-dominant) (S4)
Northern White Cedar	Northern white cedar swamp (flat with peat accumulation) (S4) Cedar-spruce seepage forest (gently sloping) (S3)
Special-value Habitats	
Riparian and Wetland Forest	Red maple-sensitive fern swamp (S4) Silver maple floodplain forest (S3) Hardwood river terrace forest (S2) Hardwood seepage forest (S3) Other communities listed above that border streams, rivers, and lakes
Vernal Pool	None

Maine Natural Areas Program Rankings:

S1: Critically imperiled in Maine because or 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[1]	Maine Natural Areas Program **Good:** Protect known occurrences. Foresters should be able to identify rare forest communities. **Better:** Manage appropriately if MNAP data suggests possible occurrences. **Best:** Conduct on-site surveys
Threatened or endangered animals	Animals listed under the federal and Maine endangered species acts	
Rare or exemplary natural communities	Natural communities classified as S1, S2, or S3 or "exemplary" communities	
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 *Biodiversity in the Forests of Maine: Guidelines for Land Management* (Elliott 1999) for more information on identifying and managing these special habitats.		

[1] Maine Natural Areas Program (MNAP) classifies rare plants and natural communities with the following system:

- S1: Critically imperiled in Maine because or 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/conserve/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-pleted (Y/N)	**Information/Action**	**Notes**
Background Data		
	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 ___Riparian zones ___Vernal pools ___Rare or exemplary natural communities ___ Old growth forest ___Significant Wildlife Habitat ___Deer wintering areas ___Heron rookeries ___*Beginning with Habitat* large forest blocks ___Other_____	
Focus Species Planning and Management		
	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

Focus Species Habitat Worksheet

Property _____ **Compartment** _____ **Date** _____ **Forester** _____

Forest Ecosystem (acres)																										Special-Value Habitats		Non-forest	
Property level	Cover Type: H, M, S, NF	Aspen-Birch				Northern Hardwood					Oak-Pine					Hemlock			Spruce-Fir					N. White Cedar			Riparian and Wetland	Vernal Pool		
Stand Number:		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		Y or N	acres	Type
For additional stands insert new rows above																													
Total:																													

Development Stage Summary-Acres							
Cover Type		R	S	I	M	L	Total
Hardwood	H						
Mixedwood	M						
Softwood	S						
Non-forest	NF						
Total							

Development Stage Summary- Percent						
Cover Type	R	S	I	M	L	Total
Hardwood						
Mixedwood						
Softwood						
Non-forest						
Total						

Ecosystem Summary -Acres							
	R	S	I	M	L	Total	%
	-acres -						
Aspen-Birch							
Northern Hardwood							
Oak-Pine							
Hemlock							
Spruce-Fir							
N. White Cedar							
Riparian/Wetland							
Non-forest							
Total							

Estimated Landscape %			
Cover Type	R+S	I	M+L
H			
M			
S			
Sum			
Devloped			
Farm			
Other			

Download this sheet in Excel format from http://www.maineaudubon.org/conserve/forest/index.shtml

Focus Species Management Worksheet

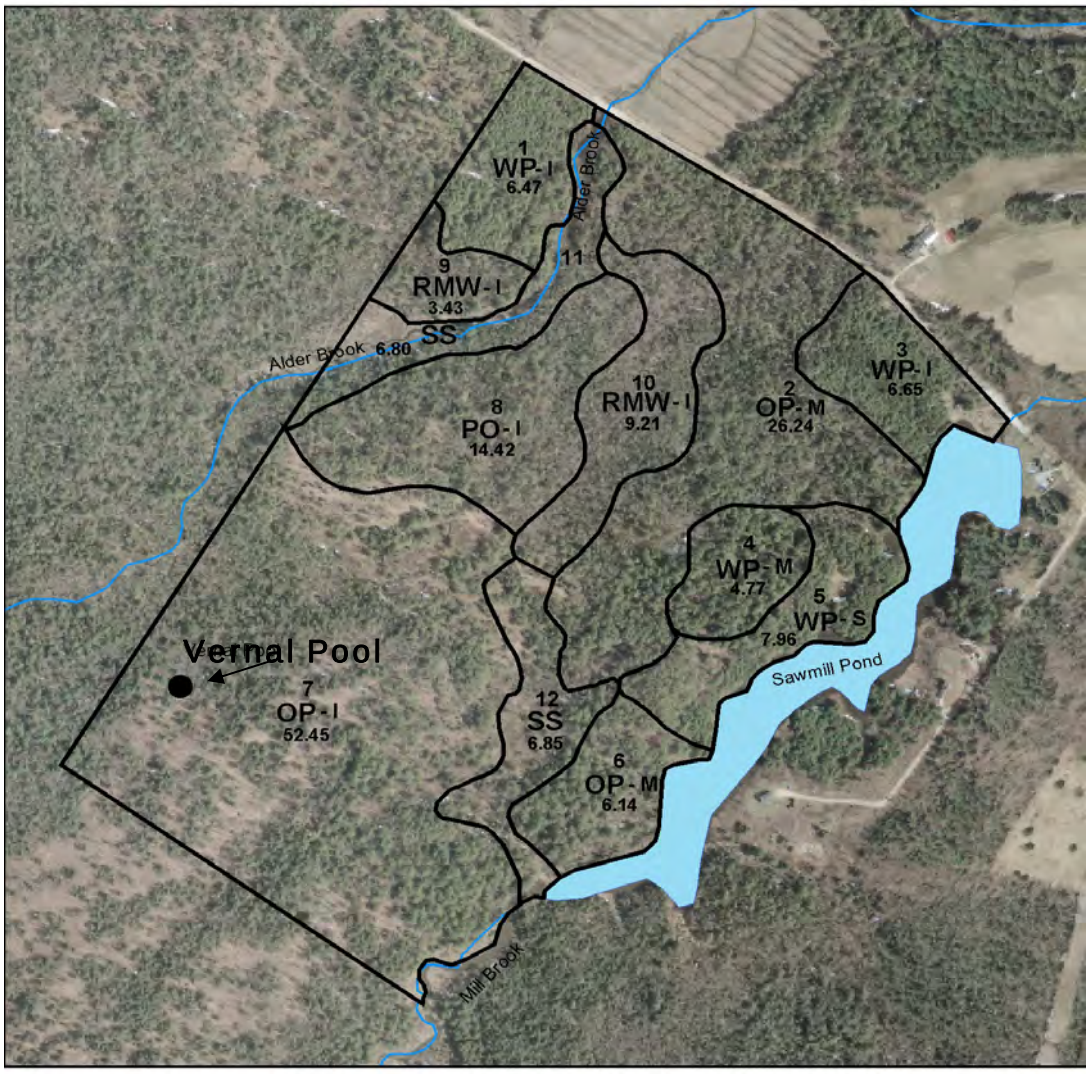
Property_____ Compartment_____ Date_____

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).

Dev. Stage	Species & (Region) (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 C	R&W	VP	
Early Succession	**Snowshoe hare**	■	■			■				
	Ruffed grouse	■	■	■						
	Chestnut-sided warbler	■	■	■						
	Eastern towhee (S)			■						
	Magnolia warbler					■				
Mature	**Fisher (S)**		■	■	■	■				
	Marten (N)		■		■	■				
	White-tailed deer (N)				■	■	■			
	Northern goshawk	■	■	■						
	Pileated woodpecker		■	■	■			■		
	B.B. Woodpecker					■	■			
	Barred owl		■	■	■					
	Wood thrush (S)		■	■	■					
	Pine Warbler			■						
	B.T. blue warbler		■							
	N. redback salamander	■	■	■	■	■				
LS	**Late-successional lichens**		■	?	?	■	?			
Riparian & Wet	Beaver							■		
	Northern waterthrush							■		
	Wood turtle							■		
	Brook trout							■		
	N. Dusky salamander							■		
VP	**Spotted salamander**								■	
	Wood frog								■	

Appendix 6. Example Stand Maps and Completed Worksheets

Type Map with Ortho Photography



Ecosystem	Development Stage
WP - White Pine	R - Regeneration
PO - Pine - Oak	S - Sapling/Small Pole
OP - Oak - Pine	I - Intermediate
RMW - Red Maple Wetland	M - Mature
SS - Shrub Swamp	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	Develop-ment 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	
7	Oak-Pine	Oak-Pine	I	52.5	Vernal pool, Mill Brook riparian zone
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	Cover Type: H, M, S, NF	Forest Ecosystem (acres)																								Special-Value Habitats		Non-forest	
		Aspen-Birch				Northern Hardwood					Oak-Pine					Hemlock			Spruce-Fir					N. White Cedar			Riparian and Wetland	Vernal Pool		
Stand Number:		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		Y or N	acres	Type
1	S												6.5																
2	M													26.2															
3	S												6.7																
4	S													4.8															
5	S											8																	
6	M													6.1															
7	M												52.5																
8	M												14.4																
9	H																										9.2			
10	H																										3.4			
11	NF																												6.8	Alder swamp
12	NF																												6.9	Alder swamp
For additional stands insert new rows above																														
Total:												8	80.1	37.1													12.6		13.7	

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	H				13		12.6
Mixedwood	M			67	6		73
Softwood	S		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.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						13.7	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_____ Compartment_____ Date_____

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).

Dev. Stage	Species & (Region) (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 C	R&W	VP	
				125				X	X	
Early Succession	**Snowshoe Hare**									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.
Early Succession	**Ruffed grouse**			X						
Early Succession	**Chestnut-sided warbler**			X						
Early Succession	Eastern towhee (S)			X						
Early Succession	Magnolia warbler									
Mature	**Fisher (S)**			X						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.
Mature	**Marten (N)**									
Mature	White-tailed deer (N)									
Mature	**Northern goshawk**			X						
Mature	**Pileated woodpecker**			X				X		
Mature	B.B. Woodpecker									
Mature	Barred owl			X						
Mature	Wood thrush (S)			X						
Mature	Pine Warbler (S)			X						
Mature	B.T. blue warbler									
Mature	N. redback salamander			X						
LS	**Late-successional lichens**			?	?		?			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.
Riparian & Wet	Beaver							X		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.
Riparian & Wet	Northern waterthrush							X		
Riparian & Wet	Wood turtle							X		
Riparian & Wet	**Brook trout**							X		
Riparian & Wet	**N. Dusky salamander**							X		
VP	**Spotted salamander**								X	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).
VP	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 Barred owl Northern goshawk	Fisher Barred owl Northern goshawk Wood thrush
Oak-Pine		Fisher Barred owl Northern Goshawk Wood thrush
Hemlock	American marten	Fisher Wood thrush
Spruce-Fir	American marten	Fisher
Northern White Cedar	Northern waterthrush	
Riparian and wetland forest	Northern waterthrush Wood turtle	Northern waterthrush Wood turtle

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

Ecosystem	Region	
	North	**South**
Aspen-Birch	See footnote[1]	See footnote[1]
Northern Hardwood	American marten[2] Barred owl Pileated woodpecker Black-backed woodpecker	Fisher[2] Barred owl Pileated woodpecker
Oak-Pine		Fisher Pileated woodpecker Barred owl
Hemlock	American marten	Fisher Pileated woodpecker
Spruce-Fir	American marten Black-backed woodpecker	Fisher
Northern White Cedar	Black-backed woodpecker	

[1] 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.

[2] 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[1]

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

[1] Depending on habitat types present, not all species may apply.
[2] 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.