

Focus Species and Conservation Forestry Practices for the Kezar River, Kezar Lake, and Cold River Watersheds



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I. Introduction

This plan has been developed to augment GLLT's *Conservation Plan for the Kezar River, Kezar Lake, and Cold River Watersheds* (January 2008 draft). In particular, this plan identifies the habitat needs of focal wildlife species and habitats within the Conservation Plan area. This plan is based on the principles of *Focus Species Forestry*¹, a guidebook that provides recommendations for traditional timber management with conservation wildlife and other components of biological diversity.

This plan was prepared as part of the Focus Species Forestry – Community Forestry Project, a cooperative venture between Maine Audubon and towns and land trusts that own managed forest land throughout Maine. The objective of the project is to involve community members and local foresters in developing ecologically based forest management plans using the *Focus Species Forestry* guidebook as a planning tool. While most of the plans prepared to date have focused on a specific property, this plan has been developed to assist GLLT's conservation planning goals by:

- Helping GLLT identify strategic land conservation opportunities based on the habitat needs of focus species;
- Identifying the needs of focal species that can be used to guide the development of habitat diversity through forest management plans.
- Providing examples of how Focus Species Forestry can be implemented on GLLT properties; and
- Presenting information that can be used in GLLT's outreach efforts with landowners, loggers, foresters, and the public.

Introduction to Focus Species Forestry

Focus Species Forestry is a method to simplify the task of integrating timber management with conservation of biological diversity, including healthy and diverse plant and wildlife habitats. It accomplishes this by identifying and managing for a few *Focus Species* whose habitat needs cover those of many other species, and by ensuring that known rare species habitat or exemplary natural plant communities are conserved. A goal of managing for the focus wildlife species is to also ensure that the natural plant diversity of the habitats they require is maintained, and that other habitats, such as dead and decaying wood used by insects and fungi, is also provided.

Details of this approach are outlined in the forest management handbook *Focus Species Forestry, a Guide to Integrating Timber and Biodiversity Management in Maine* which was published by Maine Audubon in partnership with the Maine Forest Service, Maine Natural Areas Program, Professional Logging Contractors of Maine, and the Small Woodland Owners of Maine. The reader is encouraged to become familiar with the *Focus Species Forestry* guidebook.

Focus Species Forestry includes a group of focus species for each of Maine's major commercial forest types. This approach helps forest managers and owners develop habitat targets for specific species, like

¹ Bryan, R.R., 2007. *Focus Species Forestry, a Guide to Integrating Timber and Biodiversity Management in Maine*. Maine Audubon, Falmouth, ME. Copies are available for \$12 by calling the Maine Audubon Conservation Department at 781-6180 x 222 or by free download from <http://www.maineaudubon.org/resource/index.shtml>.

the fisher and snowshoe hare, which are associated with some of Maine's most common forest types. By providing adequate habitat for a suite of focus species that represent the range of habitats and stages of forest maturity in the region, many other components of biodiversity will benefit as well. See the following sections and the appendices for more details.

Overview of Habitat Types and Species Groups for Focus Species Forestry in Maine	
Habitat Type	Examples of Focus Species
Early-successional Forest	Ruffed grouse, chestnut-sided warbler
Large areas of older Intermediate and Ecologically Mature Forest	Northern goshawk, wood and hermit thrush, fisher and marten
Late-successional Forest	Certain lichens
Riparian Management Areas	Beaver, brook trout, dusky salamander
Vernal Pools	Spotted salamander, wood frog
Dead and Decaying Wood and Tree Cavities	Pileated woodpecker, barred owl
Other Special-value Habitats	Important wildlife and plant habitats mapped by the Maine Department of Inland Fisheries and Wildlife and the Maine Natural Areas Program.

On large ownerships (thousands of acres) the goal would be to try providing all of these habitat types. On smaller parcels (tens to hundreds of acres) it may not be possible to provide habitat for both young and mature-forest species at the same time. On smaller woodlots the goal should be to 1) protect the values associated with unique and/or special value habitats such as late successional forest, vernal pools, riparian areas, dead and decaying wood and known special value habitats and 2) consider the character of the surrounding landscape while deciding on management for young and old forest habitat. For example, if young forest is lacking in the area, a goal might be to create some patches of young forest habitat. The character of the existing forest and other landowner objectives will also play an important role. A general approach suitable to many small ownerships is to manage primarily for mature-forest character while occasionally making small openings in the forest (1/10 to 1/2 acre or more) that will provide patches of early-successional habitat.

Forest Ecosystems and Development Stages

Focus Species Forestry classifies the Maine forest into six broad Forest Ecosystem types and two commonly found special habitats as shown in the following table. As used in Focus Species Forestry, a **Forest Ecosystem** is a broad group of related forest plant communities. A forester or conservation planner may assign one or more forest plant cover types to each of the broad Forest Ecosystem groups.

Maine Forest Ecosystem and Special Habitats for Focus Species Forestry		
Focus Species Habitat Classification	Description	GLLT Watersheds
Aspen-Birch	Aspen and/or paper birch are the dominant species. Typically develops in small to large patches (up to several hundred acres) after heavy disturbance (fire or clearcutting). Early successional, often followed by one of the other types listed below.	√
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. In northern New England is typically a “matrix” forming ecosystem that covers large areas of the landscape where better soils are found.	√
Oak-Pine	Includes stands ranging from pure oak to pure white pine as well as mixes with red maple, hemlock, or northern hardwoods. This is the dominant matrix forming ecosystem in southern Maine and central/southern New England.	√
Hemlock	Stands with >50% hemlock dominance; often an inclusion within larger matrix forming forest plant communities.	√
Spruce-Fir	Stands ranging from pure red spruce to pure balsam fir, sometimes with a significant white pine, hemlock, or hardwood component. Matrix-forming ecosystem in northern New England on cool, moist, and /or lower-fertility sites.	√
Northern White Cedar	Includes both northern white cedar swamps found in level basins or cedar-spruce seepage forests on gentle slopes.	None known
Special-value Habitats		
Riparian and Wetland Forest	Forest areas bordering 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.	√

Focus Species ecosystem classification may include several natural plant communities or forest stand types under each ecosystem heading. Land managers will want to know if there are any rare natural communities known to the Maine Natural Areas Program, and they should be able to identify those forest and woodland types that might be encountered in a managed forest situation.

In addition to ecosystem type, the relative age or “development stage” of a forest plays a major role in the types of wildlife and other components of biodiversity that are found there. After a severe stand-replacing disturbance such as fire or heavy harvesting, forests typically undergo a somewhat predictable pattern of stand development stages that begins with small seedlings and, absent another severe disturbance, culminates in old growth after 150 or more years. A heavy harvest can set the forest back to an earlier development stage, while a light harvest can be used to maintain the current development stage, allow the most desirable trees to grow, and allow the stand to move to a more mature stage.

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 (see the table “*Overview of Habitat Types and Species Groups for Focus Species Forestry in Maine*” in Section I). While most plants and animals in the northeast seem to be found in either young or mature forests, research has found that several species of lichens are more frequently associated with late-successional or old-growth forests. Stand development stages are shown in the following table.

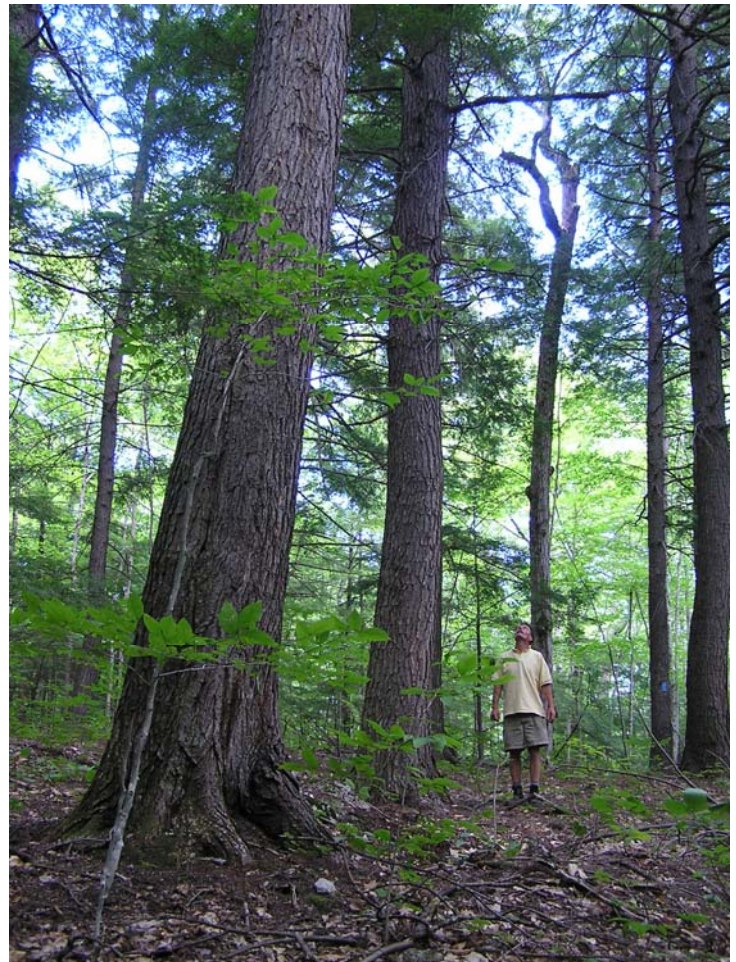
Stand Development Stage ¹		Typical characteristics ²
Early Successional	Regeneration and Seedlings	<ul style="list-style-type: none"> • Most trees >1 inch DBH. • Typically 0-10 years.
	Saplings and Small Poles	<ul style="list-style-type: none"> • Trees 1-5 inches DBH occupy more of the forest than smaller or larger trees. • Typically 10-30 years old.
Intermediate		<ul style="list-style-type: none"> • Trees 5-12 inches DBH (5-9 inches for spruce-fir) occupy more of the forest than other sizes. • Overstory typically 30-70 years old.
Ecologically Mature		<ul style="list-style-type: none"> • Trees > 12 in DBH (>9 inches for spruce-fir) occupy more of the forest than other sizes. but not meeting the definition of "late successional." • Overstory typically 70-100+ years depending on forest type.
Late Successional		<ul style="list-style-type: none"> • Trees > 16 inches DBH (> 12 inches for spruce-fir) occupy more of the forest than other size classes. • Large dead and downed wood accumulating. • Transition from mature to late successional is generally in the 100-125-year age range.
Old-Growth		<ul style="list-style-type: none"> • Generally >150 years old.

¹ Foresters and other land managers should refer to the Focus Species Forestry guidebook for technical specifications of these stages.

² DBH: diameter at breast height (4.5 ft.). Diameters and ages are general guidelines only and will vary based on site characteristics, stand history, and forest type.

Focus Species as a Conservation Planning Tool

The same species and habitats that are used to develop a habitat management plan for forestry operations can also be used to help land trusts and other conservation groups identify landscape-scale conservation needs. For example, in identifying how much of a large forest block might be desirable to protect, a conservation group might consider the habitat needs of the northern goshawk. Likewise, town governments can also use focus species to develop comprehensive plans and zoning based on species they would like to maintain within the community, and as a tool for reviewing conservation elements of development plans.



Old Growth hemlock on GLLT's Bishop Cardinal preserve

II. Focus Species for Conservation Planning and Forest Management

GLLT's draft *Conservation Plan for the Kezar River, Kezar Lake, and Cold River Watersheds* (the "*Conservation Plan*") identifies a number of key "conservation targets" and focus areas in the region. Examples of some important species were included in the Conservation Plan. Here we take a more in-depth look at key focus species and their habitat needs as they relate to GLLT's conservation targets

The focus species included in this report are vertebrate wildlife species characteristic of the GLLT watersheds and surrounding areas. Rare species and uncommon or sensitive natural plant communities identified in the Conservation Plan are generally not addressed here, except those with a wide distribution in the area that should generally be addressed in land planning and management decisions (e.g., in locations where rare plants or sensitive ecosystems are known to occur).

Forest Focus Species ¹ for Conservation Planning and Forest Management in the GLLT Region		
GLLT Conservation Plan Target	Habitat Conservation and Management Goals	Focus Species
Lakes and Ponds	<ul style="list-style-type: none"> • Protect water quality and aquatic habitat. • Maintain healthy riparian zones for plant and wildlife habitat. 	Bald eagle, wood duck, pileated woodpecker
Streams and Rivers		Wood duck, brook trout, wood turtle, beaver, northern dusky salamander, pileated woodpecker
Wetland Communities and Vernal Pools		Spotted salamander, wood frog, northern waterthrush
Agricultural Lands	<ul style="list-style-type: none"> • Provide habitat for edge/open area species. • Maintain functioning buffers between agricultural areas and water courses. 	White-tailed reer and riparian rpecies in applicable buffer zones
Unfragmented Forest Blocks	<ul style="list-style-type: none"> • Identify and preserve large forested blocks and corridors linking them to retain viable native wildlife populations. • Encourage forest management to reflect a natural range of age classes and forest types throughout the project area. • Increase knowledge of rare/exemplary natural community types and rare plant occurrences and assess their viability. 	<p>Early Successional Forest</p> <p>Ruffed grouse, chestnut-sided warbler, snowshoe hare</p> <p>Ecologically Mature and Older Forest</p> <p>Fisher, northern goshawk, black-throated blue warbler, blackburnian warbler, wood thrush, pileated woodpecker</p>

¹ Includes forest and shrub habitat species.

Focus Species Habitats and Management Objectives for the Kezar River, Kezar Lake, and Cold River Watersheds

Species	Conservation Targets: Forest Development Stages and/or Special-value Habitats	Rationale for Selection	Habitat Management Objectives for GLLT Preserves and Private Woodlands
Snowshoe Hare	Early successional softwoods (optimal) and mature/late successional forest and forested wetlands with conifer understory.	Key prey species for carnivores and raptors; important game species.	Create snowshoe hare habitat as a by-product of regeneration harvests in softwood stands.
Fisher, Bobcat	Extensive forest blocks and connecting forest corridors. Fisher is generally associated with mature forests but both species are found in a variety of forest development stages.	Sensitive to habitat loss and fragmentation.	Small woodlots as well as larger ownerships can contribute to the connected habitat matrix needed by these species. Forest practices should maintain and recruit den trees, large downed logs, and other structural features and a diversity of age classes to maintain habitat for prey species.
White-tailed Deer	Large stands of relatively mature softwood required for winter cover; edge/open areas for feeding.	Winter cover required by deer benefits many other species; culturally important game species.	Maintain and restore historical deer wintering areas and travel corridors and maintain cover and browse with periodic harvesting.
Ruffed Grouse & Chestnut-sided Warbler	Early successional and intermediate hardwoods.	Important prey species for raptors; important game species.	Periodically regenerate 1-10-acre patches of deciduous forest.
Blackburnian Warbler	Mature mixed hardwood-conifer forests.	Softwood inclusions of hemlock and spruce are key habitat elements within the northern hardwood ecosystem.	Maintain or develop patches of dominant and codominant conifers within hardwood-dominated areas.
Black-throated Blue Warbler	Intermediate and mature northern hardwoods with a developed shrub/sapling layer.	Uniquely associated with northern hardwoods.	Maintain mature northern hardwoods with well developed understory layers with uneven-aged management or a 2-aged shelterwood system.
Pileated Woodpecker, Wood Duck, and Barred Owl	Large snags, cavity trees, and live decaying trees.	Pileated woodpeckers require the largest cavity tree of any woodpecker. Management for this species will ensure that the habitat needs of smaller woodpeckers and secondary cavity nesters (e.g., wood duck, hooded merganser, and barred owls) as well as other organisms associated with dead, decaying, and downed wood will be met.	Implement guidelines for wildlife trees, downed wood, and retention patches in riparian corridors and in upland forests.
Northern Waterthrush	Shrubby habitat near water bodies and in forested wetlands with standing water.	Representative of important wetland and riparian habitats in the GLLT watershed region.	Implement riparian management guidelines.
Brook Trout, Wood Turtle & Northern Dusky Salamander	Cool, well-oxygenated streams in forest-dominated watersheds.	Maintaining cool, clear water required by brook trout and northern dusky salamander (in intermittent streams) will ensure habitat needs of other stream species are met.	Implement riparian management practices for intermittent and perennial streams. Consider a 25-50 ft. no-harvest buffer to contribute to the large woody debris pool in streams.
Beaver, Wood Turtle	Low-gradient streams and associated riparian zones.	Beavers are “keystone” species that create habitat used by ducks, moose, herons, otter, and fish. Old beaver meadows are important non-forested wetland habitats. Wood turtles are often associated with larger streams than those dammed by beaver.	Apply riparian management guidelines. Maintain beaver colonies when feasible and use water control structures when necessary to maintain pond levels in sensitive areas.
Bald Eagle	Lakeshores and major rivers.	Threatened species, popular with the public	Maintain super-canopy pines for roost and nest trees and implement other lakeshore harvesting guidelines.
Spotted Salamander, Wood Frog	Vernal pools and uplands within 800 ft., at minimum for pools with 2 or more indicator species or > 20 egg masses of one species.	Uniquely dependent on fishless pools within an intermediate to mature forest patch that provides cool, moist leaf litter. Adults and tadpoles of the vernal pool-breeding wood frog are important prey for many reptiles, birds and mammals.	When planning a harvest identify and map vernal pools prior to snowfall and implement vernal pool habitat management guidelines.
-----	Late successional forest	Non-vertebrate ecosystem elements (e.g., certain lichens) are typically absent or very limited in younger forests.	Protect existing late successional and old growth stands and identify opportunities to allow some stands to develop into late successional condition.

1. See **Focus Species Forestry** guidelines for details on management for Focus Species, forest ecosystems, and special habitats.

III. Forest Management Recommendations for Wildlife and Other Biodiversity

The following section describes general management goals and practices that can be incorporated into forest management plans within the GLLT region. These goals and practices incorporate *Focus Species Forestry* principles and could be used on GLLT preserves, private lands subject to conservation easements, other private woodlands, and public forests.

Management Goals and Desired Future Conditions

A key element of forest management planning is to define goals for long term forest management. **Goals** are broad statements that define end states (**Desired Future Conditions**) or values that the owners hope the forest will provide. Goals are then used to help define management specific **management objectives**, which are typically time-specific, measurable actions or results.

Forest Management Goals

Goals Applicable to all Forest Lands

- Restore the ecological health of the forest, including to a natural diversity of species, habitats, and forest age classes.
- Protect sensitive and rare ecosystems and species.
- Maintain soil productivity and water quality.
- Provide habitats that are declining in the region, including large blocks of relatively mature forest and patches of young-forest habitat.

Landowner-specific Goals (will vary with landowner)

- Provide recreational opportunities, such as hiking, hunting, and nature observation.
- Provide timber products that are important to the local economy and used by all people of Maine.
- Protect cultural legacies, such as stone walls and cellar holes, associated with the agricultural history of the woodlots.

Desired Future Conditions

The desired future condition is a vision of what forests in the GLLT region could look like in the long-term, 50 years or more in the future.

The Desired Future Condition includes well-managed, ecologically mature and developing upland forests that are comprised mainly of long-lived and late-successional species and that are interspersed with young-forest patches to provide a diversity of plant and wildlife habitat. These managed forests buffer and protect lakes and ponds, streams, wetland ecosystems and other sensitive areas.

Landscape and Watershed Perspective

When managing for biodiversity, it is important to consider how the forest influences and is influenced by the surrounding landscape. This may be important for species that are associated with large blocks of forest and use the property as part of their overall territory, and when considering unique habitats that may be present on the forest that are not found elsewhere on the landscape.

Different forested properties may have different landscape values. Some woodlots are located along streams, ponds, or wetlands and therefore provide valuable habitat to species that live in and move along riparian corridors. Other woodlots provide habitat connections between larger forest blocks where development or agricultural lands fragment forest habitat. Many properties are part of a larger block of unfragmented forest. By itself an individual woodlot may not provide sufficient habitat for species that avoid fragmented forests, but in sum an area of several hundred to several thousand acres made of up of many woodlots has important habitat values.

The GLLT watersheds are blessed with many large blocks of forest that provide habitat for species with large territories such as bobcat, fisher, and northern goshawk. In addition, development and agriculture is relatively sparse, so there is strong habitat connectivity that allows animals to move between the larger blocks of forest.



Special Management Areas

Before developing plans for general forest management zones it is essential to identify and map sensitive habitats and buffer areas and adopt appropriate management guidelines. Special management areas are known to occur within the GLLT watersheds. Other sites may be identified upon more detailed review of a specific forest area.

Rare Species, Natural Communities, and Significant Wildlife Habitat

The Conservation Plan maps show information on wildlife and plant habitats of concern known to the Maine Department of Inland Fisheries and Wildlife and Maine Natural Areas Program. While this information is useful when considering the landscape context of a property, when preparing a forest management plan for an individual property the Maine Natural Areas Program should be contacted for any site-specific information they may have on record.

Identifying Unmapped Natural Communities

The Maine Natural Areas Program data presented in the Conservation Plan identifies known locations of rare natural plant communities. Because not all areas have been surveyed, there is a chance that rare communities could occur on other forestlands in the region. Foresters and other land managers should be aware of rare forest and woodland natural community types that might be encountered when harvesting timber. Based on the forest types known to occur in the region, there is a small chance the following natural communities (as defined by the Maine Natural Areas Program) could occur on managed forestlands:

- Maple-basswood-ash forest
- White oak-red oak forest
- Red pine-white pine forest
- Silver maple floodplain forest
- Basswood-ash-red maple floodplain forest
- Hardwood (sugar maple/red oak) river terrace forest
- Hardwood (ash, maples, yellow birch) seepage forest
- Cedar-spruce seepage forest
- Ironwood-oak-ash woodland
- Birch-oak talus woodland

If stands that appear to fit these community types are observed when planning operations, contact the Maine Natural Areas Program for additional details on identification and management recommendations. If their presence is confirmed, a management approach that maintains and restores natural community species composition and structure is recommended.

Riparian and Wetland Habitats

Identification and Ecological Significance

Riparian areas are areas that are influenced by, and that influence, aquatic habitats. Over 60 wildlife species in Maine are dependent on riparian habitats for part of their life cycle, and many others are frequently found in riparian habitats. Riparian areas often extend beyond areas subject to Shoreland Zoning and also include areas near small and unmapped streams or small wetlands that may not be subject to Maine's Shoreland Zoning law.

Many riparian and wetland habitats may be identified on topographic maps, Beginning With Habitat Maps, on National Wetland Inventory Maps, and on the Wetland Characterization Maps on the Maine Office of GIS (MEOGIS) website. These maps should be supplemented with a careful review of aerial photos and on-site reconnaissance before snowfall.

Recommendations

- Within 100 ft. of streams and wetlands <10 acres, and within 250 ft. of wetlands >10 acres apply the **Riparian and Wetland Forest Recommendations** on page 31 of *Focus Species Forestry*.
- Review the local Shoreland Zoning regulations and maps and ensure that any harvests at minimum meet that standard.



Seeps and intermittent streams are often unmapped and should be identified before snowfall if winter operations are planned.

Vernal Pools

Identification and Ecological Significance

Vernal pools are small, fishless ponds that provide breeding habitat for a unique group of amphibians and invertebrates, including spotted and blue spotted salamander, four-toed salamander, wood frog, and fairy shrimp. Vernal pools are best identified in spring when breeding adults and/or eggs are present (typically mid April to early May for the GLLT area). By mid or late summer they are frequently dry.

Recommendations

- Conduct vernal pool surveys in April through early May.
- Check sites for possible vernal pools prior to harvesting.
- If present, apply the Focus Species Management guidelines on page 33 of the *Focus Species Forestry* guidebook.



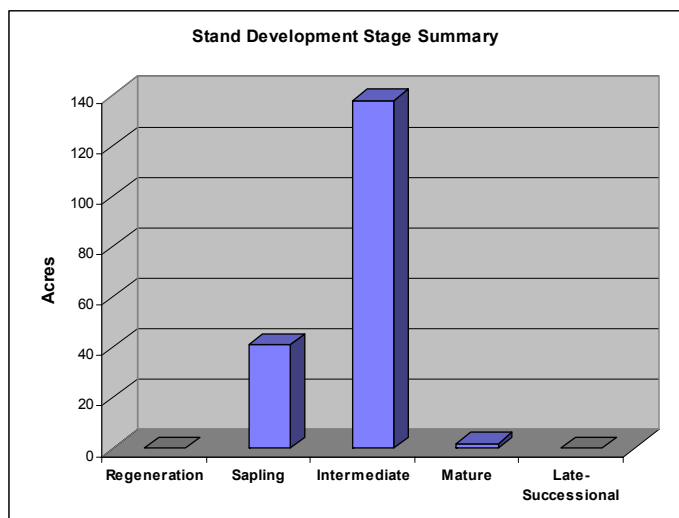
Central Maine vernal pool: May (left) and September (right)

General Forest Management Guidelines

Management Recommendations to Reach Desired Future Conditions

A forest seldom has an ideal balance of stand development stages, and long-term management should focus on improving that balance while managing for timber and other objectives. Many forests in Maine are dominated by stands in the intermediate development stages, with ecologically mature habitat and early successional habitat being often under-represented. To increase habitat diversity over time and provide habitat for both the early successional and mature forest focus species listed in the summary table, the long term goals should be to:

1. Increase the area in mature stands by careful tending of intermediate stands.
2. Allow portions of some mature stands to develop into a late successional condition.
3. Periodically regenerate some stands to a continual supply of early successional (regeneration and sapling) habitat through patch cutting or shelterwood management, while maintaining other stands in an older-intermediate and mature condition with uneven-aged management.



4. Create a diversity of habitat patch sizes (a “patch” is an area of similar habitat conditions). To encourage habitat heterogeneity, Hunter (1990)² has proposed the following rule of thumb:

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

For a hypothetical 1,000 acre forest, this might mean allocating roughly 200 acres to very small openings, such as uneven-aged management using the single tree selection method, 200 acres to group selection with patches of 0.1-0.25 acres, 200 acres in patches of 0.25-5 acres, and 200 acres in patches of greater than 5 acres using the shelterwood or clearcut method. This rule of thumb would need to be tailored to local forest types, current stand sizes and conditions, and landowner goals. It is not intended to be a formula applied to a forest but rather it is included here to provide an analytical tool for evaluating patch size diversity that will be created by the management plan.

Stand development profile of a typical Maine forest. Over time the area in sapling and intermediate stands will decrease as the forest matures. The landowner may want to consider a long-term approach to harvesting that continues to create patches of young-forest habitat (regeneration and sapling) while overall maintaining a generally mature forest.

5. Locations of harvest blocks should consider habitat needs across the property, especially for interior forest species.

² Hunter, M.L., Jr. 1990. *Wildlife, Forests, and Forestry. Principles of Managing Forests for Biological Diversity*. Prentice Hall, Englewood Cliffs, NJ.

6. Consider setting aside an area as a no-harvest reserve. This might be a sensitive ecological area or merely an area of representative forest that would be allowed to develop old growth conditions. In addition to providing ecological benefits, a reserve also provides educational opportunities and serves as a benchmark to compare with managed stands. Currently GLLT has 4% of its land in no-cut reserves outside of riparian management zones.

General objectives for forest development stages and patch sizes are included in the following table. The table also includes general silvicultural recommendations that can be used to develop and maintain those objectives over time.

Development Stage Objectives and Silviculture Systems Used to Create Desired Future Conditions			
Habitat goal	General Long Term Habitat Objective	Harvest Patch Size	Silviculture Method
Early Successional Forest	5%	0.25-2.5 ac.	Large group selection or group shelterwood
	10%	2.5-5 ac.	Shelterwood or small patch cuts
	Property and landowner-specific	>5 ac.	Shelterwood or clearcut
Intermediate	Varies with landowner objectives and silviculture method		Thin even-aged stands or begin selection harvests if goal is an uneven-aged stand. Consider regenerating areas to early successional habitat if timber quality is unacceptable and outstanding biodiversity values are not present.
Ecologically Mature, and Late Successional Forest	40-50%	<0.25 ac. if uneven-aged management, variable if even-aged	<i>Uneven-aged:</i> Single tree selection, small group selection, expanding gap. <i>Even-aged:</i> irregular shelterwood and/or extended rotation (80-100+ years)
No harvest reserve	10%		No harvest

Notes:

1. Long term habitat objectives are general guidelines and should be modified based on landowner values, property size, and surrounding landscape conditions.
2. Create a range of patch sizes with each silviculture method. If larger gaps are unacceptable, use the group shelterwood system with gaps of 0.25-0.5 acres to meet the total acreage objectives for young-forest habitat.
3. Mature and late successional habitat objective is the maximum possible after allowing for early successional habitat and "no harvest" management.
4. For larger early successional patches, an irregular shelterwood that results in a two-aged stand is generally preferred to shelterwood harvests that create a single aged stand. The expanding gap method may also be appropriate as these stands mature.
5. It may take 30-50 years to reach Desired future Conditions. Develop a 10-year harvest plan to begin moving the forest in the desired direction revise as needed every 10 years or so.
6. Assumes Focus Species guidelines for all habitats and structures are being applied.

Ecosystem Type Management Recommendations

- ✓ Strive to maintain the current mix of forest ecosystem types to favor habitat for plants and wildlife associated with the mixed northern hardwood/mixed conifer forests of the area. Where hardwood stands predominate, develop and maintain inclusions of hemlock and spruce with the main crown canopy.
- ✓ Maintain a seed source of oak and white pine in all stands when present as a hedge against climate change (see section below).
- ✓ For each planned harvest, develop a harvest plan with silvicultural prescriptions that are consistent with the **Focus Species Management** recommendations in **Focus Species Forestry**, Chapter 5, for each of the Forest Ecosystem types.
- ✓ Non-forest habitats: Old field and brush habitats provide important wildlife values. Consider keeping some landings of other areas in grasses and legumes maintained by annual mowing and occasional lime. Periodic (3-5 year) bush hogging of brushy areas can provide additional wildlife habitat diversity. Wild turkey, woodcock, song sparrows, and yellow warblers are examples of species that would benefit from this type of management.



Above: Older forests like this hemlock-hardwood stand at the GLLT Creeper Hill preserve have complex structures such as downed logs and large trees that provide conditions not found in younger stands.

Right: Understory development in harvest gap. This regeneration provides cover for mammals such as snowshoe hare and breeding and feeding sites for bird species that do not inhabit the forest canopy.



Wildlife Trees, Retention Patches, and Woody Biomass

Identification and Ecological Significance

Wildlife trees include:

- **Snags:** Dead standing trees.
- **Cavity or den trees:** Live trees with nesting cavities or mammal dens.
- **Recruitment trees:** Large live tree that will be permanently retained (i.e., will never be harvested) and will eventually contribute to the snag, cavity tree, and downed woody material for wildlife and other biodiversity benefits. Typically these are large trees with significant decay or other cull defect, or beech with evidence of bear use.

Downed Woody Material: Fallen tree trunks and branches.

Retention Patches: Areas of roughly ¼ acre or larger that are reserved from harvesting, or managed with light thinning to maintain the overstory, in single-age and two-aged (clearcut and/or shelterwood) silvicultural systems when large harvest openings (over 10 acres) are created.

Wildlife trees and downed woody material are recognized for their value to vertebrate wildlife (e.g., woodpeckers, marten, wood ducks, and salamanders), insects, and fungi and for their role in the cycling of nutrients and organic matter in the forest. All sizes provide value, but large cavity trees (> 16 inches) are required by species such as barred owl and wood duck. The value of downed woody material also increases with size.

Retention patches are important to retain a habitat “lifeboat” for species with low mobility (e.g., understory herbs, lichens, mosses and liverworts) whose habitat would be eliminated by even-aged management practices that clear most vegetation when regenerating the forest. Retention patches over one acre in size have the best temperature, humidity, and light conditions for retaining understory plants.

Wildlife Tree and Retention Patch Guidelines

The following are general guidelines for Maine harvest conditions, including stem-only and whole tree harvests. With the increase in biomass harvesting for wood energy, retaining live and dead woody material to conserve associated biodiversity and long-term soil productivity will become increasingly important.



Stand-scale Harvest Retention Guidelines for Wildlife Trees and Woody Biomass

General Guidelines for all Managed Stands

Dead Snags	<ul style="list-style-type: none"> • All dead snags should be considered for retention. • Under conditions where hand crews are operating, snags that represent a hazard should be felled at the logging contractor's discretion as needed to comply with safety guidelines. • Felled snags should be left in place.
Live Cavity Trees and Recruitment Trees	<ul style="list-style-type: none"> • The general guideline is: <ul style="list-style-type: none"> ◦ Four trees per acre >12" dbh, including one >18" dbh. • Select cavity trees first, if present, and then use recruitment trees to meet the guideline as needed. Retain a mix of species characteristic of the stand. • All live cavity trees with evidence of advanced decay and signs of use by wildlife should be considered for retention. However, cavity trees (<12" dbh) may be removed from the stand for silvicultural purposes unless there are not enough larger trees to meet the objective. • Trees suitable for consideration as recruitment trees include live pulpwood-quality trees of large diameter (>14" dbh) with evidence of interior defect and decay. Yellow birch and aspen with broken tops and maples with dead limbs in the lower crown are good candidates for consideration. Larger is better. • When possible, avoid timber harvesting from April through mid July to avoid disrupting nesting birds and denning animals.
Downed and Dead Woody Debris	<ul style="list-style-type: none"> • Avoid damaging existing downed woody material during harvesting, especially large (12"+) logs and stumps. • Attempt to leave large (>12 inch dbh and > 6 feet long) cull logs on site. Culls bucked out at the landing should be hauled back in the woods. • If whole-tree harvesting, retain and scatter tops, limbs and smaller trees from 20% of the trees harvested.

Retention of Live Trees in Even-aged Regeneration Harvests

Harvest block <10 ac.	<ul style="list-style-type: none"> • Leave the amount specified in the <i>General Guidelines for All Managed Stands</i> • Additional overstory retention may not be needed if adjacent stands are in long-term uneven-aged management. • Retain understory vegetation on ≥20% of the area.
Harvest block >10 ac.	<ul style="list-style-type: none"> • Leave the amount specified in the <i>General Guidelines for All Managed Stands</i>. • Leave representative uncut overstory in patches on ≥5% of the area. Larger patches (≥1 ac.) are preferred to protect forest understory vegetation. Identify retention patches prior to initial shelterwood cuts. • Retain understory vegetation on ≥20% of the area.

Notes:

- Diameter targets for standing trees and downed logs will vary with forest type and site.
- Where trees of sufficient diameter to meeting the targets are not present, retain the largest trees present and attempt to achieve a similar basal area in retained trees.
- Not all stands can meet targets for numbers of wildlife trees at all times, and small scale variability (e.g., on any given acre) may be significant. Therefore, it may be appropriate to attempt to meet targets across several stands.
- Avoid or minimize biomass harvests in riparian zones, rare plant and wildlife habitats, and on low productivity sites and other sensitive areas. Avoid repeated biomass harvests on the same site.
- **CAUTION! Dead and decaying trees are very dangerous, and loggers may need to fell them to comply with safety policies. If so, they should be left on the ground to provide habitat.**

Source: Developed by Maine Audubon (May 2008) based on *Biodiversity in the Forests of Maine* (C.A. Elliott, ed., U. Maine Coop. Extension 1999), other wildlife tree recommendations from multiple northeastern wildlife authors and researchers, and *Biomass Harvesting Guidelines for Forestlands, Brushlands, and Open Lands* (Minnesota Forest Resources Council, December 2007). The 20% understory retention guidelines for even-aged harvest is not included in the above but is recommended by Maine Audubon to help ensure that understory plant species and structure will become a significant part of the future stand.

Invasive Plants

Identification and Ecological Significance

Invasive exotic plants have been recognized as a serious threat to many forest ecosystems in the Northeast. Several species of exotic shrubs found in Maine's forests can displace native understory plant species and prevent or severely limit the regeneration of trees, thereby affecting the long-term composition and integrity of the forest. The most problematic invasive species include non-native honeysuckles, two buckthorn species, Japanese barberry, and Asiatic bittersweet (see Appendices).

Recommendations

Early detection and control is the key to managing invasive species. Early control will help minimize the risk of infestation of nearby stands and properties.

Survey woodlands for invasive species. GLLT could enlist volunteers to survey its properties for invasive species. Private woodland owners should include invasive species inventory as part of a forest management plan. On all woodlots, carefully survey areas for invasive species before harvesting. Because many invasive plants leaf out before native species, Spring (late April or early May) just before native species break bud is an excellent time to survey for invasive plants.

Develop and implement an invasive species control plan based on the results of invasive species surveys.

Because most invasive plants sprout vigorously when cut or from broken roots when pulled, carefully targeted use of herbicides is the most effective means of control. On public lands the assistance of a licensed herbicide applicator is usually required. Private forests open to the public (e.g., land trust properties) may not need a licensed applicator if the treatment is done by an employee or volunteer. *Check with the Maine Board of Pesticide Control for applicable regulations.* In all cases label directions and applicable safety procedures should be followed. Low-toxicity herbicides can be safely applied in small quantities to control invasive shrubs. Brushing freshly cut stems or the base of small stems, rather than spraying, is a safe and effective method that will minimize chemical use. A two-year post-treatment check and, if needed a follow up treatment, should be included in the plan. A general overview of control methods is included in the Appendices. Herbicide type, concentration, carrier, and method of application will vary with species and season of treatment.



Invasive bush honeysuckle. Exotic invasive plants may eventually dominate the understory and prevent establishment of native trees, shrubs, and herbs. Spring is a good time to search for invasive plants because many leaf out before native species.

Recreational Use

Well used recreation trails have the potential to disturb some wildlife species. Disturbance will vary with species, usage level and type, and season. Following are some general considerations for ecologically friendly trails:

Considerations for Recreation Trail Design and Use	
Trail Design and Layout	<ul style="list-style-type: none">✓ Well used recreation trails have the potential to disturb some wildlife species. Disturbance will vary with species, the usage level, type, and season.✓ When planning trails, create long perimeter loops that leave large patches of habitat undisturbed rather than crossing all sections of a woodlot.✓ To minimize disturbance to aquatic wildlife trails should not run parallel with the shore of water bodies and open wetlands. Rather, approach water bodies with spur trails to a screened viewpoint or have loop trails only approach the shoreline for short distances.
Mechanized Use	<ul style="list-style-type: none">✓ Mountain bikes increase the potential for permanent soil damage, off-trail use, and conflicts with other users. However, mountain bikes have no more impact on wildlife than pedestrians.✓ ATV use can cause severe soil damage, impact water quality, and affect forest values for other users of the area. Where ATVs are not wanted, trail design techniques can minimize the attractiveness to ATV use.✓ Where ATV use is an objective, trails should follow the general design and layout principles above and use appropriate techniques to minimize damage to soils and water quality. Stream crossings and associated approaches, wet sites, and erosion on steep trails should be primary considerations.✓ Trails should avoid sensitive winter habitats such as deer wintering areas and be planned to minimize conflicts with non-mechanized users.
Pets	<ul style="list-style-type: none">✓ Require that dogs be leashed during the nesting season of ground-nesting birds (April to end of July). Examples of ground nesting birds that might be found include woodcock, hermit thrush, and ovenbird. Dogs should also be leashed during winter when snow restricts animal movement and cold temperatures require energy conservation for survival.

Planning for Climate Change

Researchers have estimated that Maine's average temperatures will increase at least by 3.5° F by 2100 if we significantly reduce climate-warming emissions, and as much as 12.5° F if emissions are not reduced. By 2100 the optimum climate for spruce and fir will have shifted to north of the Canadian border, while the optimum climate for northern hardwoods such as sugar maple and yellow birch will retreat to the western mountains and northwestern highlands of Maine. The northern limit of optimum climate for oak, which is now best adapted to southwestern Maine, will shift north to the Canadian border. Trees that are outside of their optimum climate are likely to become stressed, with potential for increased rates of tree health decline and mortality due to insects and diseases. Disturbances, including harvests and other management actions, can be used to facilitate the response of vegetation types to climate change.

Most of the northern species in the planning areas except for white pine, red oak, and red maple are expected to be increasingly stressed by global warming. The following general recommendations should be considered in developing harvest plans and other activities.



American beech (foreground), yellow birch, sugar maple, and red spruce may decline as the climate warms. Red oak, white pine, and red maple are well adapted to a warming climate.

Climate Change Forest Management Recommendations

- ✓ Consider the implications of management 100 years or more in the future.
- ✓ Because tree species ranges are likely to migrate north at one fifth to one tenth of the rate of climate change, manage for a diversity of tree species, including those such as white pine and red oak, which are adapted to a warmer climate. Other species to favor include white oak, shagbark hickory, and red maple.
- ✓ In areas currently characterized by cool-climate species such as spruce and fir, northern white cedar, or northern hardwoods, leave seed sources of pine, oak, hemlock and other warmer-climate species, if present.
- ✓ If warmer-climate species are absent, consider planting a few acorns or pine and hemlock seedlings after harvest to establish a future seed source that will facilitate the expansion of these populations. Planting blight-resistant American chestnut should also be considered.
- ✓ Landowners and managers can help mitigate climate change by sequestering carbon in soils, the forest floor, and in the canopy. Forest soil carbon loss can be minimized by avoiding clearcutting and other practices that heat the forest floor and increase oxidization of organic matter. Managing for older and larger trees will store more carbon on the stump. Conservation easements can ensure that the land is not converted to a carbon-consumptive use. While most often associated with private land, conservation easements can also be applied to public forest land to ensure that the land is not converted to other public uses.

Education Plan

GLLT could consider developing interpretive materials and programs for the forest that explain its ecological features and objectives of forest management and use its managed forest preserves as model forests for other landowners in the area to view.

Community forests provide excellent educational opportunities for adults and younger students. An education and outreach plan can help involve the community in stewardship of the forest.



Monitoring Plan

A comprehensive approach to ecologically sustainable forestry involves monitoring of the forest. This information will be used to update new management plans, track progress toward meeting goals, evaluate the success of past treatments (e.g., harvests to promote regeneration or invasive species control treatments) and need for follow up, monitor for potential adverse impacts of management (e.g., soil erosion on skid trails), and provide timely data so that the management plan can be modified to react to changing conditions.

The following table includes both “strongly recommended” and “desirable” monitoring recommendations. The “desirable” recommendations and some of the “strongly recommended” items could be undertaken by volunteers.

Monitoring Recommendations			
Element	Strongly Recommended	Desirable	Frequency
Forest Inventory	<ul style="list-style-type: none"> • Tree species, size and density (all trees >1 in. dbh). • Focus Species Ecosystem and Development Stage. • <i>Refer to Maine Forest Service Stewardship Plan inventory requirements.</i> 	<ul style="list-style-type: none"> • Species distribution by canopy layer (overstory, understory, ground cover) and percent cover of each layer. • Shrubs, wildflowers and other herbs, ferns and bryophytes. • Snags, cavity trees, and large downed woody material. 	Every 10 years.
Invasive plants	<ul style="list-style-type: none"> • Harvest sites: pre-harvest inventory; develop control plan if present. 		Prior to harvests.
	<ul style="list-style-type: none"> • Evaluate success of treatments and prescribe follow-up control as necessary. 		1 year after treatment, every 5 years thereafter.
	<ul style="list-style-type: none"> • Entire forest: include as part of regular 10-year inventory. 		Every 10 years.
Regeneration	<ul style="list-style-type: none"> • Quantitative or qualitative monitoring designed to see if regeneration objectives are being met. 		Within 3 years of a regeneration harvest and during forest inventory.
Erosion and sedimentation	<ul style="list-style-type: none"> • Check roads, skid trails, water crossings, and landings. 		During harvest operations, 1 year after harvest (or sooner if very heavy rains) and within 3 years.
Wildlife Inventory	<ul style="list-style-type: none"> • Summarize forest cover types by Focus Species ecosystem and development stage (or similar system) every 10 years. 	<ul style="list-style-type: none"> • Breeding bird inventory • Winter mammal tracking • Owl nesting surveys 	Annually for 3 years to establish baseline, every 5 years thereafter.
Rare Plant Inventory		<ul style="list-style-type: none"> • Searching for rare plants in enriched hardwood sites and other unique habitats. 	Once. Periodic monitoring thereafter (e.g., every 5 years) if any rare species are found.

IV. Appendices

Frequently Asked Questions about Focus Species Forestry

How does timber production fit in?

Focus Species Forestry is designed to be used by any landowner, including those whose primary objective is income from timber production. The different habitat management strategies are linked to management techniques used in commercial forestry. The key to achieving focus species objectives is in the planning for the location, timing, and intensity of timber harvests based on the habitat need of focus species.

How does this differ from other wildlife management guides?

Focus Species Forestry differs from other guides for forest wildlife management because it is primarily a guide for maintaining and restoring biodiversity and the ecological health of managed forests, not simply management for vertebrate wildlife species. While ***Focus Species Forestry*** uses wildlife species to help develop an integrated approach to ecosystem management, the individual species, or wildlife habitat in general, are not intended to be the only end points of management.

How many species do I need to consider?

Most of the species in the guide are what conservation biologists call “umbrella species.” By managing for one of these species, a forester or landowner can be reasonably assured that other species that share the same habitats will also benefit. On most woodlots a forester could develop a framework for management based on the habitat needs of less than 10 of the 25 species in the guide, thus greatly simplifying the process of developing a biodiversity-friendly management plan.

The species we are most interested in are not in the guide. What should we do?

Depending on the area under management, the ***Focus Species Forestry*** approach can be used to maintain suitable habitat conditions for all wildlife that inhabit the forest types on the property. However, if a landowner has a strong interest in a particular species that is not featured in this guide (for example, wild turkey or woodcock) other sources should be consulted for management recommendations specific to those species. Those species would then become a primary focus species for that property and might form the core of the management plan. Other focus species and the habitat guides from the ***Focus Species Forestry*** guidebook would then be incorporated into the plan to ensure that a diverse and healthy forest ecosystem is maintained.

If the goal is biodiversity, then why use only vertebrate species?

Most landowners relate more quickly to vertebrates than to other elements of biodiversity, so the focal species in the guide become “ambassadors” for the other elements of biodiversity. Also, we know more about how to manage most vertebrates than invertebrates or other life forms. For those landowners with little knowledge of forestry the guide can provide assurances that forest management is an appropriate stewardship function.

How do rare, threatened, or endangered species and natural communities fit in?

Before the plan is prepared information on rare species and habitats known to the Maine Natural Areas Program and Maine Department of Inland Wildlife is used to identify areas of special management concern. Other sensitive sites that are identified during the field inventory are identified and included in the management plan.

Maine Inland Vertebrate Wildlife Species of Greatest Conservation Need ⁱ

Speciesⁱⁱ	Primary Habitatⁱⁱⁱ	Forest Maturity^{iv}	ME Risk Priority^v	ME SGCN Priority^{vi}	ME Listing^{vii}	Federal Listing / Priority^{viii}
BIRDS						
Blackpoll Warbler (W, N, E)	F: C	1	3	---		P
Spruce Grouse (N, E)	F: C	1-2	3	---		P
Canada Warbler	F: C	1-3	2	Very High		P
Purple Finch	F: C	1-3	2	Very High		
American Three-toed Woodpecker (N, W)	F: C	2-3	2	Moderate	SC	
Bay-breasted Warbler (W, N, E)	F: C	2-3	2	Very High		P
Cape May Warbler (W, N, E)	F: C	2-3	2	Very High		P
Northern Parula	F: C	2-3	2	Very High		
Red Crossbill (N, E, W)	F: C	2-3	2	Very High		P
Chestnut-sided Warbler	F: D	1	2	Very High		P
Willow Flycatcher (S)	F: D	1-2	2	High		
Rose-breasted Grosbeak	F: D	1-2	2	Very High		
Blue-gray gnatcatcher (SW)	F: D	1-3	2	High		
Veery	F: D	1-3	2	Very High		P
Yellow-bellied Sapsucker	F: D	2-3	2	High		
Great-crested Flycatcher	F: D	2-3	2	Very High		
Wood Thrush	F: D	2-3	2	Very High		P
Yellow-throated vireo (SW)	F: D	2-3	2	High		
Scarlet Tanager	F: D	2-3	2	Very High		
Eastern Towhee (S, W, E)	F: D, Mx	1-2	2	High		
Eastern Screech Owl (SW)	F: D, Mx	1-3	2	High	Sc	
Barred Owl	F: D, Mx	2-3	2	High		
Black and White Warbler	F: D, Mx	2-3	2	Very High		
Black-throated Blue Warbler	F: D, Mx	2-3	2	Very High		P
Louisiana Waterthrush (SW)	F: D, Mx	2-3	2	High		P
Northern Flicker	F: D, Mx, C, NF	1	2	High		P
American Woodcock	F: D, W	1-2	2	High		P
Red-shouldered Hawk	F: D, W	2-3	3	---		P
Long-eared Owl	F: F: C	2-3	2	Moderate		
Northern Goshawk	F: H, Mx	2-3	3	---	SC	SC
Blackburnian Warbler	F: Mx	2-3	2	Very High		P
Cooper's Hawk	F: Mx	2-3	3	---	SC	
Black-throated Green Warbler	F: Mx, C	2-3	2	Very High		
Bicknell's Thrush	F: Subalpine	1-2	1	Highest	SC	SC
Peregrine Falcon	NF		1	Highest	E	P
Common Loon	NF		2	High		P
Bald Eagle	NF		2	High	T	T
Common Nighthawk	NF		2	High		
Whip-poor-will	NF		2	High		
Chimney Swift	NF		2	High		
Eastern Kingbird	NF		2	High		

Species ⁱⁱ	Primary Habitat ⁱⁱⁱ	Forest Maturity ^{iv}	ME Risk Priority ^v	ME SGCN Priority ^{vi}	ME Listing ^{vii}	Federal Listing / Priority ^{viii}
Baltimore Oriole	NF		2	High		P
Brown Thrasher	NF, D	1-2	2	Very High		
American Bittern	W		2	High		P
Black-crowned night heron	W		2	High	SC	
Great Blue Heron	W		2	Moderate		
American Black Duck	W		2	High		P
Black-billed Cuckoo	W		2	High		
Rusty Blackbird (N, E)	W		2	Very High	SC	
Olive-sided Flycatcher	W, C	1	2	Very High	SC	P
Wood Duck	W, D	2-3	---	---		P
Northern Harrier	W, NF		3	---		P
MAMMALS						
Canada Lynx (N)	F: C	1	2	High	SC	T
Eastern Red Bat	F: D	1-3	3	---	SC	
Long-tailed shrew	F: D, Mx, C	1-3	3	---	SC	
Hoary Bat	F: D, Mx, C	1-3	3	---	SC	
Little Brown Bat	F: D, Mx, C	1-3	3	---	SC	
Northern Long-eared Myotis	F: D, Mx, C	1-3	3	---	SC	
Sliver-haired Bat	F: D, Mx, C	1-3	3	---	SC	
Rock Vole	F: F: D, Mx, C	1-3	3	---	SC	
Big Brown Bat	NF		3	---	SC	
REPTILES and AMPHIBIANS						
Eastern Box Turtle (SW)	F: D, MX, C	1-3	1	High	E	
Northern Leopard Frog	NF	1-3	3	none	SC	
Wood Turtle	S, D, Mx, C	1-3	2	High	SC	
Northern Spring Salamander	S, D, Mx, C	1-3	3	none	SC	
Blue-spotted Salamander	VP, D, Mx	1-3	2	High	none	
Blandings Turtle	W		1	Highest	E	
Spotted Turtle (SW)	W		2	High	T	

Species of Conservation Concern: Total By Habitat		
Habitat	MDIFW	USFWS
Young-Intermediate Forest	7	7
Intermediate-Mature Forest	19	8
Any-aged Forest	12	1
Vernal Pool/Forest	1	0
Forest Streams	2	0
Wetlands	9	7
Other Non-Forest	11	4
Total	61	27

ⁱ Includes forest-dependent species and non-forest species that may be seasonally associated with forest or forest riparian zones, exclusive of fish and invertebrates.

ⁱⁱ Includes general range within Maine in parenthesis. Range is statewide unless noted as follows): E- east; N- north; S- southern half of state; SW- extreme southwest (S&W of Portland); W- west.

ⁱⁱⁱ Primary Habitat (ME Audubon classification): F: forest; D – deciduous forest; C – coniferous forest; Mx – Mixed deciduous-conifer forest; S – stream; VP- Vernal Pool; W – wetland (non-forest shrub or open-emergent), NF – other non-forest

^{iv} Forest Maturity (ME Audubon classification) : 1 – regeneration/sapling/small pole; 2 – intermediate age; 3 - mature

^v Maine Risk Priority (Maine Conservation Wildlife Strategy, MDIFW Sept. 2005):

- 1 - High potential for state extirpation without management intervention and/or protection
- 2 - Moderate to high potential for state extirpation without management intervention and/or protection
- 3 – Low potential for state extirpation, yet there are some remaining concerns regarding restricted distributions, status, and/or extreme habitat specialization.

^{vi} Species of Greatest Conservation Need Priority (SPGN). Source: Maine Conservation Wildlife Strategy, MDIFW Sept. 2005. Priority ranking combines risk of extirpation with knowledge and readiness for action.

^{vii} Species listed under Maine's Endangered Species Act. T –Threatened; E- Endangered, SC – Special Concern

^{viii} Federal Listing/Priority: T – threatened; E – Endangered; SC – special concern; P – other Gulf of Maine Watershed Priority Species that are a) candidate species for federal T&E listing, b) migratory birds that are declining nationwide, c) migratory birds listed as Threatened or Endangered by 2 or more states in the watershed, and d) other migratory birds of concern identified by the N. American Waterfowl Management Plan, US Shorebird Conservation Plan, Colonial Waterbird Plan, or Partners in Flight. Source: US Fish and Wildlife Service Gulf of Maine Program, watershed Habitat Analysis Fact Sheet (http://www.fws.gov/northeast/gulfofmaine/projects/habitat_analysis.htm)

Source: http://maine.gov/ifw/wildlife/groups_programs/comprehensive_strategy/table_contents.htm

Most Problematic Invasive Plants in Maine

Most Problematic Terrestrial Invasive Plant in Maine		
Common Name	Scientific Name	Habitat
Barberry, Japanese	<i>Berberis thunbergii</i>	Forest understory
Buckthorn, common	<i>Rhamnus cathartica</i>	Forest understory
Buckthorn, glossy	<i>Frangulus alnus</i>	Forest understory
Honeysuckle, bush	<i>Lonicera morrowii</i>	Forest understory
Honeysuckle, Japanese	<i>Lonicera japonica</i>	Forest understory
Honeysuckle, Tatarian	<i>Lonicera tatarica</i>	Forest understory
Japanese knotweed	<i>Fallopia japonica</i>	Edges
Bittersweet, Asiatic	<i>Celastris orbiculata</i>	Edges, forest canopy vine
Loosestrife, purple	<i>Lythrum salicaria</i>	Wetlands
Rose, multiflora	<i>Rosa multiflora</i>	Old field, edges
Source: Maine Natural Areas Program 2006		

Control of Invasive Terrestrial Plants in Maine

Common Name	Scientific Name	Habitat	Control
Autumn Olive & Russian Olive	<i>Eleagnus umbellata</i> , <i>Eleagnus angustifolia</i>	Edges and open areas	Mechanical: Pull smaller plants, followed by mowing or pulling sprouts as needed. Chemical: Glyphosate on cut stumps. (1)
Barberry, Japanese	<i>Berberis thunbergii</i>	Forest understory	Mechanical: Pull shrubs, followed by mowing or pulling sprouts. Flame torch to lower stem may also be effective. Chemical: Glyphosate or triclopyr on cut stumps. (1, 2)
Bittersweet, Asiatic	<i>Celastris orbiculata</i>	Edges, forest canopy vine	Mechanical: Repeated cutting or pulling plants. Chemical: Glyphosate or triclopyr on cut stems. Seed bank may necessitate treatments repeated for several years. The flowers and fruit of Asiatic bittersweet grow from the joints where leaves join the vine, whereas American bittersweet's flowers are in terminal clusters. (1)
Buckthorn, common & glossy	<i>Rhamnus cathartica</i> <i>Frangulus alnus</i>	Forest understory	Mechanical: Flame torch stems <42 inches diameter. If cutting, repeated treatment is required. Chemical: Glyphosate or triclopyr cut stem or foliar treatment. Treat in fall when green leaves persist after native trees and shrubs have lost their leaves. Resprouting may occur and seed bank may last 3 years. (1, 2)
Honeysuckle, bush Honeysuckle, Tartarian	<i>Lonicera morrowii</i> <i>Lonicera tatarica</i>	Forest understory	Mechanical: Cutting, burning. Repeated treatments may be required. Chemical: Glyphosate or triclopyr on leaves or cut stumps. (1, 2) Note: all non-native shrub honeysuckles have a hollow pith that is usually brown
Honeysuckle, Japanese	<i>Lonicera japonica</i>	Forest understory	Mechanical: Pull shrubs and roots when soil is moist (repeated treatment likely required). Chemical: Glyphosate or triclopyr on leaves or stems. A vine that is distinguished from Maine's rare native vine honeysuckles by the separate leaves at the tip of the stem (on natives, a single fused terminal leaf wraps around the stem). (1)
Knotweed, Japanese	<i>Fallopia japonica</i>	Edges	Mechanical: Repeated cutting (3 or more times/season). Chemical: Cutting followed by glyphosate (repeat may be necessary). (1)
Mustard, garlic	<i>Alliaria petiolate</i>	Forest understory, esp. moist/rich soils	Mechanical: Hand pulling in early season. Chemical: Glyphosate foliar or dormant season basal spray. (1)
Loosestrife, purple	<i>Lythrum salicaria</i>	Wetlands	Mechanical: Pulling individual plants. Chemical: Glyphosate foliar spray or cut stem treatments. Biological: Release of beetles that feed exclusively on loosestrife has been effective on large infestations. (1)
Rose, multiflora	<i>Rosa multiflora</i>	Old field, edges	Mechanical: Repeated mowing (up to six time per year for 2 years). Chemical: Glyphosate or triclopyr in cut stems. (1, 2)

Notes:

- This table is intended to provide a broad overview of problematic forest invasive species and methods to control them. Consult the sources below and other experts (e.g., an ecologist and/or forester and a licensed herbicide applicator) to develop and implement an invasive species control plan.
- Herbicides used on areas open to the public must be applied under the supervision of a licensed applicator, or for terrestrial application only if applied by an employee or volunteer and the area is closed for 7 days.
- Both glyphosate ("Roundup," Rodeo," "Accord" etc.) and triclopyr ("Garlon," "Pathfinder," "Remedy," "Renovate," "Tahoe," etc.) may be used on forests certified by the Forest Stewardship Council if the [FSC Pesticide Policy](#) is followed (as of 2007).

References:

- [University of Maine Invasive Plant Fact Sheets](#)
- [Wisconsin Manual For the Control of Ecologically Invasive Plants](#)

Other Sources of Information:

[Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas](#) (The Nature Conservancy; mechanical and chemical control methods)
[The Nature Conservancy - Wildlands Invasive Species Program](#) (information, links, workshops, on-line forums, etc)
[Weeds Gone Wild: Alien Plant Invaders of Natural Areas](#) (lists, species fact sheets, and other information)

Selected Focus Species Profiles

Beaver

For profiles of all Focus Species, download the **Focus Species Forestry** guidebook from the Maine Audubon website at <http://www.maineaudubon.org/resource/index.shtml> or order a copy by calling 207-781-6180 x 222

Note: Image quality in the downloadable PDF and hard copy is significantly better than these copies.

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

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

Black-throated Blue Warbler

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	R	S	I	M	L	R	S	I	M	L			

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

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

Focus habitat
Other habitat
Little/no use

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

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		

RRegeneration and seedlings

S Saplings and small poles

I Intermediate-aged forest

M Mature forest

L Late-successional forest

MxMixed conifer-deciduous

U Understory present

C Cavity tree or snag

Focus habitat

Other habitat

Little/no use

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

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

Focus Species Forestry Habitat Management Guides

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)

To see habitat guides for all Maine forest ecosystems, download the **Focus Species Forestry** guidebook from the Maine Audubon website at <http://www.maineaudubon.org/resource/index.shtml> or order a copy by calling 207-781-6180 x 222

Note: Image quality in the downloadable PDF and hard copy is significantly better than these copies

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	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ 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

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 (<i>Lobaria pulmonaria</i>)

¹conifer understory present

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 (<i>Bryoria capillaris</i>)

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	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ 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

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 Species¹

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.

Focus Species Management

Water Body	Width (ft.)	Focus Species/ Primary Management Goals
Seeps, intermittent streams	≤75	Focus Species: Northern dusky salamander Management Goals: <ul style="list-style-type: none"> Protect water quality by avoiding soil disturbance and sediment runoff. Maintain shade along stream channel.
Small- to medium-sized perennial streams (first- and second-order streams) ¹	75-250 ²	Focus Species: All Management Goals: <ul style="list-style-type: none"> Protect water quality and maintain shade. Manage for large snags and cavity trees.
Large streams and rivers (third- and fourth-order streams) ¹	≥250	Focus Species: Freshwater: All except dusky salamander Coastal waters: Pileated woodpecker only Management Goals: <ul style="list-style-type: none"> 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.
Ponds and non-forested wetlands <10 acres	75-100	
Ponds and non-forested wetlands >10 acres; coastal waters	≥250	
Recommendations: <ul style="list-style-type: none"> 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. 		

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 inaccurate; 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

