A Landowner's Guide –

Wildlife Habitat Management for Lands in Vermont

VERMONT FISH AND WILDLIFE DEPARTMENT

A Landowner's Guide –

Wildlife Habitat Management for Lands in Vermont

Vermont Fish and Wildlife Department

in partnership with

Vermont Department of Forests, Parks and Recreation

Natural Resources Conservation Service,
U.S. Department of Agriculture

Published by Vermont Fish and Wildlife Department

Printed in the United States of America 5 4 3 2 1

ISBN: 0-9772517-2-1

Designed by RavenMark, Inc.
Printed by:
Illustrations: Pages 41-42, Edward Epstein; All else: Adelaide Tyrol Murphy

FSC logo here

A Landowner's Guide –

Wildlife Habitat Management for Lands in Vermont

Vermont Fish and Wildlife Department

AUTHORS:

David Adams
MaryBeth Adler
Cedric Alexander
Amy Alfieri
John Austin
Doug Blodgett
John Buck
Ken Cox
Scott Darling
Mark Ferguson
Paul Hamelin
Forrest Hammond
John Gobeille
Everett Marshall
Douglas Morin
Steve Parren
Kim Royar
David Sausville
Eric Sorensen
Robert Zaino

EDITORS:

Toby Alexander
Tom Rogers
Michael Snyder
Susan Warner

CONTENTS

FOREWORD

Vermont has a rich tradition of thoughtful land management, rural communities tied to working lands, and strong appreciation for fish and wildlife. Ultimately, fish and wildlife conservation begins with proper management and stewardship of land and habitat. As most land in Vermont is privately owned (approximately 85 percent), fish and wildlife conservation is inextricably tied to the decisions of private landowners and how they manage their lands. In fact, private landowners are among the most important partners we have to ensure a successful future of wildlife conservation and healthy habitats.

Therein lies the purpose behind the Vermont Fish and Wildlife Department's efforts to create guidelines for the effective management of wildlife habitat. We are excited to offer this manual to provide useful information and guidance to landowners, foresters, wildlife biologists and others interested in managing land for the benefit of fish and wildlife. This represents an essential element to our ability to successfully realize our mission of conserving all species of plants and animals, their habitats, and the myriad benefits they provide to the public.

Our hope is that the information and ideas in this manual receive wide application, and our expectation is that they serve as a basis for the Department's efforts to work in partnership with Vermont landowners. From managing forests for ruffed grouse and wild turkey, and grasslands for bobolink and meadowlarks, to managing wetlands for herons and wood ducks, we believe that these guidelines provide useful information to ensure effective, long-lasting stewardship for these precious resources.

Louis Porter, *Commissioner*
Vermont Fish and Wildlife Department

Michael Snyder, *Commissioner*
Vermont Department of Forests, Parks and Recreation

We are excited to offer this manual to provide useful information and guidance to landowners, foresters, wildlife biologists, and others interested in managing land for the benefit of fish and wildlife.

ACKNOWLEDGMENTS

We wish to thank the private landowners of Vermont who provide the inspiration to foster a strong sense of thoughtful land stewardship.

The Vermont Fish and Wildlife Department wishes to express its sincere appreciation to all the individuals and organizations that helped create this product. The Vermont Department of Forests, Parks and Recreation was instrumental in the development of these guidelines and offered outstanding and essential guidance and information. In particular, Commissioner Michael Snyder, Director of Forests Steve Sinclair, and Forest Mangement Chief Ginger Anderson provided strong, helpful support and guidance to make this a useful tool for Vermont landowners. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) played a similar partner role and also provided outstanding and essential guidance and information. In particular, Toby Alexander, NRCS state biologist and acting forester provided thoughtful guidance, support and information in the development of these guidelines. Vermont Audubon, Vermont Coverts, and Vermont Woodlands Association all provided guidance and support for the development of these guidelines.

We are particularly grateful to all the wildlife biologists and county foresters within the Vermont Agency of Natural Resources who contributed to this effort. They not only represent the driving force behind this product, but are the boots on the ground, day in and day out, who work with private landowners to improve wildlife habitat. And, of course, we wish to thank the private landowners of Vermont who provide the inspiration to foster a strong sense of thoughtful land stewardship.

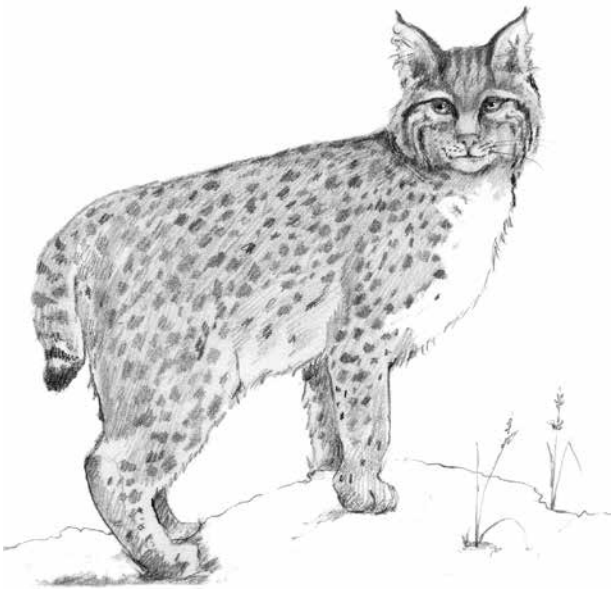
INTRODUCTION

These guidelines are intended to provide useful information and techniques for private landowners, wildlife biologists, foresters and other land managers on how to effectively manage land to improve wildlife habitat. They have been developed for a wide audience to benefit wildlife habitat management on private lands throughout Vermont. Therefore, they represent a balance of technical information presented in an easy to use and understand format so that landowners as well as professional foresters can use them. These guidelines are voluntary and do not have any regulatory influence or application to private lands. In fact, they have been specifically designed to help landowners understand how to go above and beyond the normal course of land management to achieve the best possible outcome for wildlife habitat.

Vermonters place high value on the environment, rural working landscape, and wildlife. Time and again, these values are highlighted in surveys that illustrate strong public support for conservation of wildlife and land. As the Vermont landscape largely comprises private land, Vermont landowners play a critical role in ensuring the future health of our lands, waters, habitats, and wildlife. And, time and again, Vermont landowners provide outstanding examples of managing land in thoughtful ways to benefit the shared interests in wildlife.

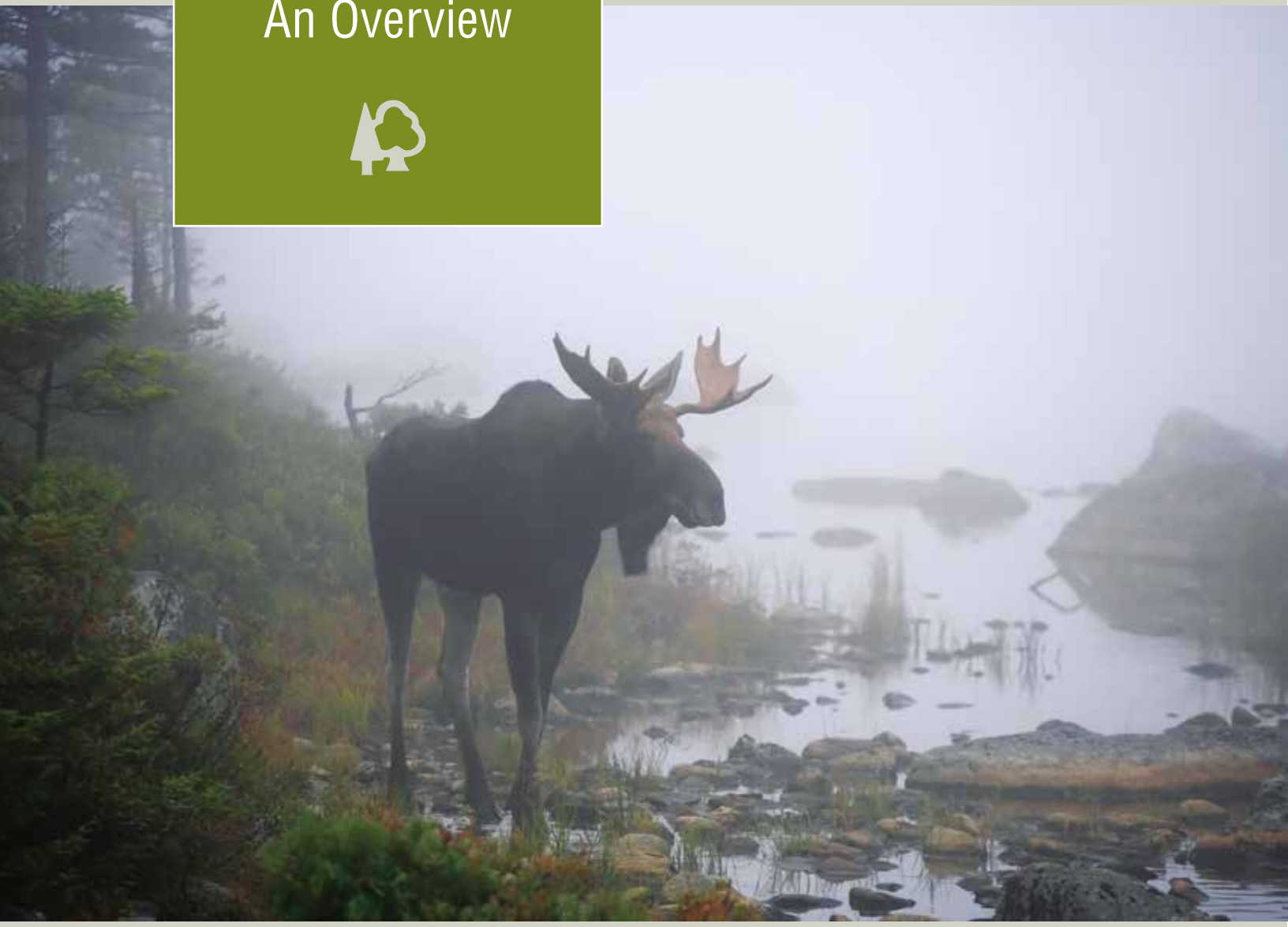
The Vermont Fish and Wildlife Department is pleased to provide these guidelines to all those who are interested in managing their land to benefit and enhance wildlife habitat and the animals that use them. We look forward to realizing healthy habitats for many generations of Vermonters yet to come.

As the Vermont landscape comprises largely private land, Vermont landowners play a critical role in ensuring the future health of our lands, waters, habitats and wildlife.



➤ PAGE ix

PART ONE:
Habitat Planning Process: An Overview



1. CONSIDERATIONS BEFORE YOU DEVELOP A PLAN

People own and value land for many reasons. Timber, firewood, bird watching, hiking, hunting, and many other values are realized from people owning land. To be sure, Vermont has a strong history and tradition associated with a rural working landscape that includes forest product economies, tourism and recreation, hunting, fishing, maple sugaring, farming, and more. This working landscape is what makes Vermont the special place it is.

This guide is intended to assist you as a landowner who is particularly interested in managing your land to benefit wildlife. That is not to say that by managing your land for wildlife you are deciding not to manage it for timber or hiking trails; indeed, many of these goals are compatible, if not complementary. Managing your land to enhance its value for wildlife requires careful attention to the species of plants and animals currently using the land as well as those desired from your management. This guide will help you, the landowner, forester, biologist, or other land manager, understand how to recognize various wildlife habitats and how to manage them for the future.

All good land management begins by creating a management plan to guide decisions and actions. Similar to developing a forest management plan, when managing your land for wildlife, the planning process should involve five steps: (1) evaluate the conditions and capabilities of the land; (2) set management goals based on your evaluation of the land and your desired outcomes; (3) consider management alternatives to be sure that your actions are the most effective to achieve your interests; (4) write a plan; and (5) implement the plan, monitor the results, and adjust your management strategies based on those results. Inherent in this process is the development of a map or maps that depict existing and desired conditions on your property.

This chapter introduces the overall habitat management planning process.

This guide is intended to assist those landowners who are particularly interested in managing their land to benefit wildlife.

Four habitat components are needed for wildlife to survive: food, water, cover, and space.

DEFINING WILDLIFE HABITAT

Before the planning process begins, you should be familiar with the concept of habitat in a broad sense. Four habitat components are needed for wildlife to survive: food, water, cover, and space. Even though all species need these habitat components, the amount and type of each required differs depending upon the species. Knowing the specific needs of each species (e.g., ruffed grouse), or group of species (e.g., grassland birds) will allow you to provide the correct habitat components to meet their needs and your interests. For more information on specific species, refer to **Part Seven: Habitat Management for Games Species** or **Part Eight: Habitat Management for Nongame Species**.

Relatedly, the term "carrying capacity" refers to the ability of a habitat to support a certain population (number of individuals) of a given species of wildlife. For instance, a limited supply of one type of habitat (e.g., habitat that provides an important source of food) will control how many of a given species of wildlife the habitat will support (e.g., acres of interior forest habitat and hermit thrush, or white-tailed deer and suitable softwood cover for winter habitat). Land managers can affect carrying capacity by providing or limiting important habitats, thus increasing or reducing wildlife populations.

PLANNING PROCESS

Evaluate the Land: Before you can effectively manage land for wildlife, you need to understand what wildlife live on the land and what habitat they require. In addition, a critical element to the planning process is to inventory and identify the habitat types and conditions on the land, and if possible, on surrounding lands owned by your neighbors. If you own forest land in Vermont, you can contact your local county forester with the Vermont Department of Forests, Parks and Recreation. That person will visit your land, free of charge, and help you evaluate the forested habitat conditions on your land. In addition, the Vermont Fish and Wildlife Department (VFWD) and the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) provide advice and planning services to Vermont landowners. You will see links to VFWD and NRCS in **Resources** sections throughout this guide.

By examining the land at different times of year, you can get a sense of the extent and diversity of habitat conditions (e.g., mast production by American beech or red oak trees in autumn). As explained in more detail in subsequent chapters, this includes identifying and assessing the number of snags (standing dead and dying trees) and the acreage and condition of a hemlock forest used as winter habitat by white-tailed deer, as two examples. Make a list of all the plants and animals you can easily identify on the land. Also, look for physical changes on the land that may vary by season. For example, look for how an opening in the forest gets shade during the growing season because this will influence how quickly it may regenerate to young forest, and look for areas that are seasonally wet and support standing water because they may be used by breeding amphibians for spawning and as sources of water for black bear and other wildlife. Examine what happens to the land and how the wildlife respond after a rain or snowstorm (e.g., deer may congregate in an area of softwood cover during winter, and mallard ducks may feed in seasonally flooded fields).

In addition, think about how your property fits into the local landscape. For example, how do your woods connect with your neighbors' lands? Do fencerows or stream corridors connect your land to other properties? What land use practices are occurring on the land around you, and what impact do they appear to have on local wildlife? Finding answers to these questions will help you to decide how to manage your property for wildlife, among other things, and whether or not your goals are realistic. In all of these larger, landscape considerations an important over-riding principle to keep in mind is, how are the habitats connected to one another, and how can those connections be maintained? Fragmenting those connections is one of the most significant impacts to many wildlife because it affects their ability to move, access important habitats, find mates to successfully reproduce, and to disperse and maintain their populations.

Although it is possible to plan and implement some habitat management practices on your own, gaining assistance from professional foresters and wildlife biologists is invaluable for realizing success and achieving your goals. Contact a regional Vermont Agency of Natural Resources (ANR) office for assistance and lists of natural resource experts (see **Resources** for contact information). Experts can provide valuable information and advice on what habitats may be present and how to best manage and enhance them. Local county foresters are an excellent source of guidance and information for developing habitat management plans and, in many instances, can guide you through how to update an existing forest management plan to include wildlife habitat. Additional information that may help in managing your land is available from many sources, including chapters in this guide, local libraries, videos and television programs, adult education courses, and individual experts.

Set and Prioritize Goals: Setting management goals is an exciting part of the planning process; this is when you decide what measurable differences to implement that will benefit wildlife. For example, your goal might be to increase the number of woodpeckers, squirrels, cavity nesting birds, and bats throughout the property. This goal might be achieved by increasing the number of snags (dead and dying trees) in a range of size classes in order to benefit those species that rely on such habitat. Another example might be to create young forest habitat to increase certain species of songbirds and ruffed grouse that rely on that habitat condition. It is important to be realistic when setting habitat management goals and base them on a thorough and thoughtful evaluation of the existing conditions of the landscape. For example, the desire to attract grassland birds is not realistic if the land you wish to manage is a 40-acre woodlot. You should become familiar with the habitat needs of the desired species, and be realistic in your appraisal of whether you can meet those needs. Think about the values you ascribe to your land as well as the health of the forest overall and how to ensure it remains healthy. Do you want it to produce income, provide hunting or other recreation, or are you more interested in aesthetic returns such as creating natural beauty, providing wildlife habitat for viewing pleasure, or protecting rare species? Through careful planning, many of these goals can be complimentary and not mutually exclusive.

Once you have established habitat management goals for the property, the next step is to develop management objectives (objectives are measurable outcomes that help meet the larger goals). Following the development of habitat objectives, another step is to identify management strategies or actions that describe what actions or mechanisms will be used or employed to manipulate or otherwise manage the habitat. Actions are task-oriented and designed to be directly implemented by

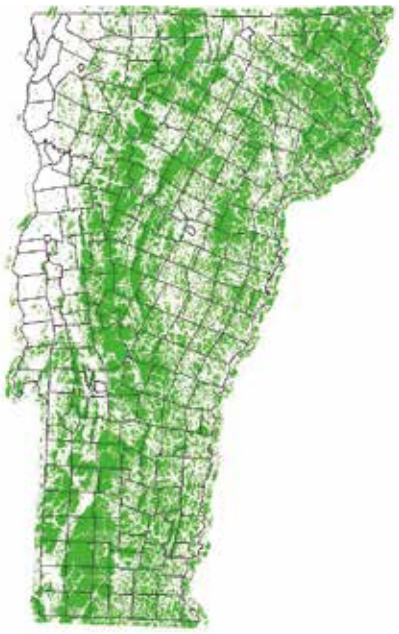


Figure 1.1 Statewide contiguous habitat map

Maps are an essential part of an effective management plan and should be detailed enough to understand existing conditions and constraints, as well as goals and objectives (desired conditions) — a picture is worth a thousand words. The ANR Natural Resources Atlas (http://anrmaps.vermont.gov/websites/anra/) is an excellent GIS tool to develop useful forest and habitat management plans.

Prioritizing your goals is a way to view the "big picture" in small, organized parts. This will help you to plan accordingly and complete the most important goals first.

the landowner or resource professional to achieve a certain outcome (e.g., pruning apple trees, delineating a buffer zone to a stream, or controlling invasive plants through hand pulling or use of herbicides). This framework of goals, objectives and strategies is commonly used for developing forest and habitat management plans and is merely a progression of how to describe what you hope to achieve and how you plan to achieve it.

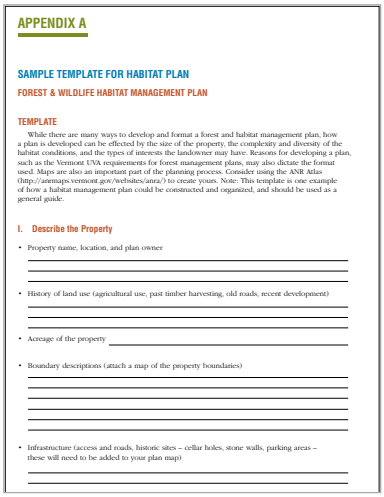
As an example, you may have a goal to attract bluebirds to your property. A review of your property suggests nesting structures and foraging habitat are lacking. One objective might be to install six nest structures to attract at least three nesting pairs within three years. The action needed to achieve that objective may include constructing and placing six nest boxes in suitable locations within the next two years. A second objective might be to provide 2 acres of high-quality foraging habitat within three years. Specific actions, such as mowing a portion of an old field, might be used to achieve the objective.

Once your goals are set, prioritize their importance and determine whether they can be realistically achieved. Prioritizing your goals is a way to view the "big picture" in small, organized parts. This will help you to plan accordingly and complete the most important goals first. Employing the services of a professional wildlife biologist or forester is a useful way to ensure that your goals, objectives and actions are appropriate and realistic given the circumstances of the land and your interests and abilities.

Consider Alternatives to Meet the Goal: Usually, a goal can be achieved in more than one way, and foresters, wildlife managers and landowners often have to sort through many options to find the best method. Every decision made will affect wildlife and wildlife habitat in some way, but some impacts may be beneficial to your goal while others may be harmful. The successful manager is one who tries to anticipate how each decision will make a difference and which decision is the best one to meet the goal.

There may be many alternatives to choose from. Once alternatives have been identified you can select those goals, objectives and strategies that are most appropriate to best meet your interests. Keep in mind that many goals can be achieved by using the same strategies. For instance, growing healthy trees for saw timber and fire wood can be done in a way that is also compatible with developing healthy habitat for forest songbirds, small mammals, raptors, and deer, as just one example. Before choosing an alternative, be sure to consider cost, time involved, and impacts on other forms of wildlife as well as impacts to neighboring landowners. Choosing alternatives with the least amount of trade-offs is usually the best option. Some important consideration include: how much time and money are required, available options for technical and financial assistance (e.g., federal Farm Bill programs like the Environmental Quality Incentive Program) and what kind of equipment is needed. Equally important are the potential impacts of management decisions on neighboring landowners and the local landscape, and the costs and benefits to a wide array of wildlife. You should also remain mindful of the economic benefits of managing forested habitat. Harvesting timber produces income for the landowner and supports a state and regional forest products economy which ultimately helps keep land in an undeveloped condition. Timber harvest activities can be designed to benefit wildlife and the income generated from the timber harvest can offset the investment for habitat management.

Write a Management Plan: After you have established habitat management goals based on a careful assessment of existing habitat and land conditions as well as an assessment of alternative management options, it's time to write a management plan. It's important to note that an assessment of land conditions includes both the physical and ecological conditions of the land, as previously addressed. Any management plan will need to address issues of topography, stone walls, streams and wetlands as they relate to access for logging equipment, as just one example. Experts who can assist you with this task, are oted in the sidebar below. The purpose of a management plan is to outline the steps needed to reach your goals. An essential first step includes developing a map that depicts the area to be managed, current physical conditions of the land (e.g., topography, roads, stone walls), ecological conditions (e.g., streams, seeps), and habitat conditions (meadows, snags, forest openings, mature forest stands), location of habitat management practices to be employed, location of structures, access roads, and other relevant information. There are many ways to create a map for purposes of planning habitat management projects. The Vermont Agency of Natural Resources offers a web-based GIS mapping tool known as the Vermont Natural Resources Atlas that is a valuable tool for this purpose. This tool provides access to important natural resource and wildlife data (e.g., deer wintering areas, rare and uncommon natural communities and species, wetlands, habitat connections, and more), aerial photography and more. It is easy to access and use and can be found at the link in **Resources**. If you already have a forest management plan through the UVA program, this can serve as an excellent opportunity to realize your wildlife habitat goals by working with your county forester and others to adjust them accordingly. In many cases, UVA plans already have been designed to meet wildlife habitat goals and serve as useful templates to neighboring landowners. Contact your county forester for more information. There are other tools and programs you can use to guide the development of a management plan such as The American Forest Foundation's "My Land Plan" program available at mylandplan.org.



APPENDIX A

SAMPLE TEMPLATE FOR HABITAT PLAN

FOREST & WILDLIFE HABITAT MANAGEMENT PLAN

TEMPLATE

While there are many ways to develop and format a forest and habitat management plan, how a plan is developed can be effected by the size of the property, the complexity and diversity of the habitat conditions, and the types of interests the landowner may have. Reasons for developing a plan, such as the Vermont UVA requirements for forest management plans, may also dictate the format used. Maps are also an important part of the planning process. Consider using the ANR Atlas (http://anrmaps.vermont.gov/websites/anra/) to create yours. Note: This template is one example of how a habitat management plan could be constructed and organized, and should be used as a general guide.

I. Describe the Property

- Property name, location, and plan owner
- History of land use (agricultural use, past timber harvesting, old roads, recent development)
- Acreage of the property
- Boundary descriptions (attach a map of the property boundaries)
- Infrastructure (access and roads, historic sites – cellar holes, stone walls, parking areas – these will need to be added to your plan map)

Figure 1.2 Sample Habitat Plan

Appendix A provides a template for how to construct and organize a habitat management plan.

WHAT TO KNOW ABOUT CONSULTING FORESTERS AND WILDLIFE BIOLOGISTS

Consulting foresters and wildlife biologists can assist Vermont landowners in developing effective forest and wildlife habitat management plans. These guidelines can help landowners decide on management goals and strategies, while consulting natural resource professionals can articulate and implement successful wildlife habitat management activities. Consulting foresters and biologists can assist with plan and map preparation for your needs, design and implement resource inventories of your land, and help you apply for federal management practices programs and Use Value Appraisal (Current Use) enrollment. In addition, these professionals provide a wealth of knowledge that they will pass along to you — the landowner. There are many consulting foresters and wildlife biologists in Vermont and New England. The Vermont Fish and Wildlife Department maintains a list of practicing wildlife consultants that can be found at: http://www.anr.state.vt.us/FWD/Consultant.aspx

Your County Forester maintains a list of consulting foresters working in your area. The Vermont Woodlands Association maintains a list of consulting foresters at: http://www.vermontwoodlands.org/documents/CFMembershipDirectory2014-15.pdf

When selecting a consulting forester or biologist consider their level of experience, and request examples of other plans they have written. Ask for references and in particular whether they have worked with any nearby landowners with whom you can speak. If you are enrolled in Vermont's UVA program, contact your county forester or the Vermont Fish and Wildlife Department for guidance if you want to update your management plan to address wildlife habitat interests.

While some habitat conditions respond quickly to management (e.g., aspen sprouting from patch cuts), other conditions require time and patience to be realized (e.g., development of riparian plantings).

Implement the Decision, Monitor the Results: Once the habitat management plan is complete you can begin to implement the various prescribed strategies in accordance with an implementation schedule. While some habitat conditions respond quickly to management (e.g., aspen sprouting from patch cuts), other conditions require time and patience to be realized (e.g., development of riparian plantings). Monitoring the results of habitat management actions during the implementation of the plan is essential for determining to what extent the management goals are achieved and whether adjustments are required to better meet the goals. For instance, if your goal is to create young softwood habitat to encourage snowshoe hare and instead the site regenerates to mixed hardwood and softwood, it may be necessary to adjust your goal and focus on encouraging habitat for other species such as ruffed grouse, if your interest is small game hunting.

Remember that natural, economic, or other conditions may change during the life of the plan and you may need to revise your goals, objectives, and strategies accordingly. For example, in the planning process, a landowner may decide to establish a 40-acre field of warm season grasses, beginning in three years. When it is time to begin the management action seed prices may have gone up and the landowner can only afford to prepare and seed 20 acres. An appropriate and reasonable alternative response to this unforeseen change is to plant 20 acres of warm season grasses, and allow the other 20 acres to revert to an old field providing valuable shrub habitat conditions. This decision allows the landowner to stay within budget, and still results in the creation of valuable habitat.

WORKING WITH NEIGHBORS

Working in partnership with other landowners is often an exciting management approach that can result in even greater benefits to wildlife given the larger area of influence. As wildlife habitat becomes more fragmented in Vermont due to the subdivision and sale of land, small property owners may find it difficult to understand and identify opportunities to manage their land for wildlife. The answer may lie in working with neighbors to create a more meaningful habitat plan. You may be able to provide one component of wildlife habitat (e.g., release oak trees to improve acorn production) and neighboring landowners may be able to provide other components (e.g., buffer to a nearby stream or wetland). For example, the wetland on one property and the old field with shrub habitat on an adjoining property can be managed together for the benefit of birds and mammals that rely on these habitats and the essential connections between them. This is also a case where working together with neighboring landowners can turn a management operation that should involve harvest of timber into something that can become economically viable. By working with multiple landowners, there may be sufficient timber as an incentive for a commercial timber harvest designed to benefit wildlife habitat. Again, experts such as county foresters, state wildlife biologists as well as local and state land trusts can be helpful in making connections between landowners to discuss how best to manage your lands collectively.

VERMONT'S USE VALUE APPRAISAL PROGRAM

The Use Value Appraisal Program (UVA), also known informally as "Current Use," is a tax incentive program for Vermont property landowners. It assesses the value of agricultural or forest land based on the current use of the land, rather than the use of greatest financial value, which is often as developed with homes or commercial structures. This program allows owners of forest land the opportunity to pay lower property taxes as long as they do not develop their land and they commit to managing their land through a forest management plan approved by a county forester.

UVA is an outstanding program in terms of the opportunities it creates for landowners interested in managing their land for wildlife. The program allows landowners to develop management plans that focus on wildlife habitat enhancement while still allowing for the economic benefits of forest products through commercial timber sales. In addition, UVA allows landowners that own land with Ecologically Significant Treatment Areas (a.k.a., ESTAs) to protect and manage those features through noncommercial methods where necessary to protect the resource. In most cases, landowners enrolled in UVA rely on the services of professional consulting foresters, wildlife biologists, and ecologists. The plans must be reviewed and approved by county foresters in the Vermont Department of Forests, Parks and Recreation. This level of professional guidance and review ensures that the plans comply with statutory and program requirements, and are appropriate, realistic and of high quality.

County foresters are available for field visits to discuss forest stewardship goals and management options. They can advise on practices programs and technical assistance available through a variety of programs and partner organizations. These range from funding options for specific activities through the Natural Resources Conservation Service to peer-to-peer networks to assessment for songbird habitat through "Foresters for the Birds."

For landowners with 25 acres or more of land, this program is recommended as a means to develop a habitat management plan. (For more information about the UVA program and for other important website links, see **Resources.** Also, note the sample plan template provided in **Appendix A**.

The UVA program allows landowners to develop management plans that focus on wildlife habitat enhancement while still allowing for the economic benefits of forest products through commercial timber sales.

RESOURCES

Degraff, R.M., M. Yamaski, W.B. Leak, A.M. Lester. 2005. *Landowner's Guide to Wildlife Habitat – Forest Management for the New England Region*. Burlington, VT: University of Vermont.

Long, S., V. Barlow, I. Post, M. Snyder, C. Thompson, C. Wooster. 2012. *More Than a Woodlot: Getting the Most from Your Family Forest*. Vermont: Northern Woodlands.

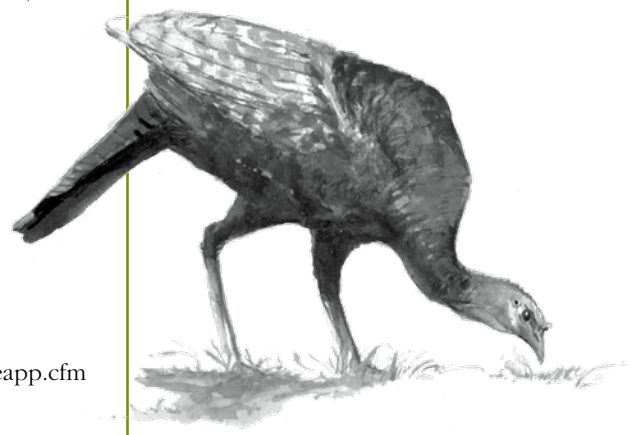
Vermont Fish and Wildlife Department. Wildlife Expertise. http://www.vtfishandwildlife.com/nnhp_expertise.cfm

U.S. Department of Agriculture. Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/site/vt/home/

Vermont Department of Forest, Parks and Recreation. County Foresters. http://www.vtfpr.org/resource/for_forres_countfor.cfm—.

Use Value Appraisal Program. http://www.vtfpr.org/resource/for_forres_useapp.cfm

Vermont Woodlands Association. Consulting Foresters of Vermont. http://www.vermontwoodlands.org/certified-foresters.asp



2. BIOPHYSICAL REGIONS AND A LANDSCAPE PERSPECTIVE FOR CONSERVATION AND MANAGEMENT

As a Vermont landowner, you will need to carefully consider the effects of your actions and plan for effective habitat management and conservation on at least three scales.

Vermont is rich with wildlife, largely because we have an abundance and diversity of habitat that supports the needs of many species. These habitats include extensive areas of interconnected forests of many types, swamps and lakeside marshes, fens and bogs, cliffs and caves, seeps and vernal pools, fields and grasslands, and streams, rivers, and ponds. An important conservation goal is to maintain this diverse array of habitats to continue to support Vermont's wildlife resources and all the values they provide.

Achieving this goal over the long term will be challenging, given the continued loss and degradation of habitat associated with development. As a Vermont landowner, you will need to carefully consider the effects of your actions and plan for effective habitat management and conservation on at least three scales. First, you need to consider the needs of individual species where they occur, especially those species that are particularly sensitive to changes in their surroundings. For example, American woodcock require shrub wetlands for feeding, adjacent to old fields for courtship.

Second, you need to consider the distribution and condition of all habitats and natural communities in your local area and across the state. This is the best insurance that you will provide the habitat requirements for a broad range of species.

And third, you need to consider large, landscape-scale features, such as large areas of contiguous forest and the habitat that connects them. Although you may make decisions on how to manage your own lands based primarily on its conditions, you should also consider these larger landscape issues in order to put the value of the habitat on the property you are managing into context.

One way to understand the complexity of landscapes in Vermont is to examine the state's biophysical regions. Vermont comprises eight distinct regions based on differences in elevation, climate, geology, topography, hydrology, land-use history, and vegetation. Although wildlife distribution was not used specifically to develop these eight biophysical regions, there are some clear patterns of wildlife species distribution across the

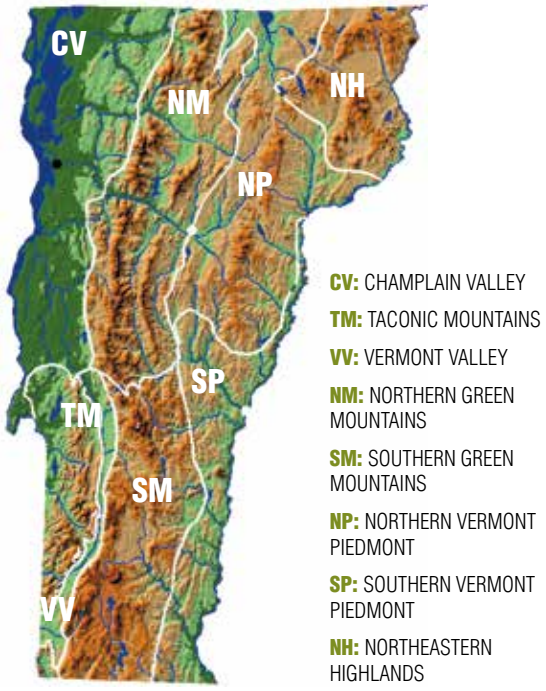


Figure 2.1 Biophysical Regions of Vermont

eight regions (e.g., montane forest birds within the high elevation habitats in the northern Green Mountains and northeastern highlands regions). Following is a brief description of each biophysical region in Vermont.

CHAMPLAIN VALLEY (CV)

Extending from the southern end of Lake Champlain and northward into Canada and along the St. Lawrence River valley, the Champlain Valley is one of the warmest regions in Vermont. It is also dry, with less than half the annual precipitation that falls in the Green Mountains. Lake Champlain and the low-elevation level plains with clay and silt soils near the lake dominate this region. Low hills rise up to the east to meet the Green Mountains where northern hardwood forests are common. On the warm rocky hills of the valley bottom, diverse forests of oak and hickory occur amid an agricultural setting. The rare Mesic Clayplain Forest once dominated the clay soils of the region but has now mostly been converted to agricultural land. Large wetland complexes of marsh, swamp, and floodplain associated with Lake Champlain and the deltas of the larger rivers provide regionally significant waterfowl and marsh bird habitat. Chittenden County is the most populated region of the state and the abundance of high-quality agricultural soils means that there are few large blocks of forest in this region.

TACONIC MOUNTAINS (TM)

This primarily forested region has complex geology, including the band of world-famous slate south of Lake Bomoseen, acidic hills of schist and phyllite, and rich limestone and marble slopes to the east. The climate is as variable as are the elevations, with Mt. Equinox rising to 3,882 feet and the Hubbardton River flowing through Benson at an elevation of 200 feet. Northern hardwood forests are common at mid-elevations and extensive rich northern hardwood forests occur on the eastern slopes. Spruce-fir forests grow on the highest elevations while oak-dominated forests grow on warm southern slopes and at lower elevations where hemlock and white pine are also common. Lakes and ponds are common to the northwestern part of the region (Bomoseen, St. Catherine, Hortonia, and Sunset), and river valleys provide productive agricultural land. The Taconic Mountains extend south into New York, Massachusetts, and Connecticut.

VERMONT VALLEY (VV)

This small, narrow region between the Taconic and Green Mountains is defined by its limestone and marble bedrock, the abundant wetlands along Otter Creek and Batten Kill River, and the low hills made up largely of well-drained, glacially derived soils. The underlying bedrock is rich in calcium, which has a strong influence on the wetlands of this region, resulting ttmany fens, seeps, and enriched swamps. Forests of oak, white pine, and hemlock are common on the coarse soils along the valley sides. The Vermont Valley has a long history of human use and now includes a major north-south road (Route 7) and train travel corridor. The valley wetlands provide important wildlife habitat, and maintaining adequate east-west wildlife corridors across the valley between the Green and Taconic Mountains will be an important challenge.

NORTHERN GREEN MOUNTAINS (NM)

The Green Mountains are part of the Appalachian Mountain chain that extends from Alabama north to Québec. The Northern Green Mountains include Vermont's highest mountain (Mount Mansfield at 4,393 feet), its coldest climate, and the greatest annual precipitation (72 inches). The bedrock is primarily acidic, composed of non-calcareous schists, phyllites, gneisses, and granofels. Northern hardwood forests blanket the region on the mountain slopes up to about 2,500 feet, above which yellow birch and red spruce are dominant. Spruce-fir forests occupy the higher slopes and summits, with alpine meadows above 3,500 feet. The extensive, unfragmented forests of this region provide habitat for many species of wildlife that thrive in remote, interior forest conditions. The high elevation forests of this region and the Southern Green Mountains provide habitat for several species of birds, including Bicknell's thrush, Swainson's thrush, and blackpoll warbler. The heavy precipitation and deep snows in the mountains feed some of the state's largest rivers, including the Missisquoi, Lamoille, Winooski, and White. Floodplain forests were once common along these rivers, but they are now mostly converted to agriculture.

SOUTHERN GREEN MOUNTAINS (SM)

This region has many similarities with the Northern Green Mountains. It has high mountains (Killington Peak is 4,235 feet), acid bedrock composed of the same material as the Northern Green Mountains, cold temperatures, heavy precipitation, and dominated by the same forest types that are largely determined by elevation. One distinct feature of the Southern Green Mountains is the relatively level plateau on the southern and western sides of the region. Here, northern hardwood forest and spruce-fir forest intermix with spruce swamps, poor fens, and small ponds. Beaver are abundant and have had a significant influence on the wetlands of the plateau. Another distinct and dramatic feature of the Southern Green Mountains is the escarpment along the western boundary. The cliffs and steep slopes of the escarpment drop more than 1,000 feet in some areas to the valleys to the west. The escarpment's acidic rock and warm western slopes support northern hardwoods, hemlock, and in many locations, oak and pine.

NORTHERN VERMONT PIEDMONT (NP)

Moderate in both its climate and topography, the Northern Vermont Piedmont is a hilly region bisected by many rivers. With rich soils derived from the underlying calcium-rich bedrock and gentle topography, this landscape is dominated by a dense network of roads connecting farms and small villages. Consequently, it contains fewer large forest blocks and has more fragmented wildlife habitat than in the Green Mountains and northeastern highlands.

The calcium-rich bedrock is responsible for the abundance of rich northern hardwood forests, northern white cedar swamps, and rich fens—all characteristic communities of this region. In contrast, the acidic granite hills of Derby, Glover, and Groton State Forest support northern hardwoods with abundant spruce and fir. The granite quarried in Barre is world famous for its high quality. The Northern Vermont Piedmont has many lakes and ponds, including the larger Memphremagog, Seymour, and Caspian, as well as numerous smaller ponds in the vicinity of Woodbury and Groton State Forest. These lakes and ponds provide successful nesting habitat for the greatest concentration of common loons in Vermont.

SOUTHERN VERMONT PIEDMONT (SP)

The Southern Vermont Piedmont is a variable region, with a cool climate in the northern hills, and some of the warmest temperatures in Vermont recorded in Vernon. The topography comprises gentle, rolling hills that rise from the Connecticut River Valley to meet the Green Mountains. Northern hardwood forest dominates throughout, but oak and pine forests occupy warm southern and western slopes in the hills of the central and southern portions of the region. Hemlock forests are also common. The Connecticut River and its tributaries provide important aquatic habitat. These river valleys also have abundant deposits of sand and gravel resulting from the last glacial period in Vermont. Although many of these well-drained soils have been developed or processed for gravel, temperate climate oak and pine forests are common on those that remain. Floodplain forests are also common along many of the region's rivers. The dense network of roads in this region has resulted in smaller blocks of forest and more fragmented wildlife habitat than in the less-developed regions. Turkey, gray squirrel, and white-tailed deer are some of the species that benefit from the abundance of acorns.

NORTHEASTERN HIGHLANDS (NH)

One of the coldest regions in Vermont, the Northeastern Highlands has a short growing season that has limited the conversion of the land for agriculture and created conditions that favor growth of coniferous forests of spruce and fir. Northern hardwood forests, as well as extensive spruce and fir forests, dominate the landscape of this region. The geology of this region is similar to that found in the White Mountains of New Hampshire and areas of northern Maine. The higher mountains are formed of acidic, weather-resistant granite, and some good examples of this include East and Gore Mountains. In sharp contrast, the distinctive Nulhegan and Victory Basins are formed from very soft granite that has eroded over long geological timeframes. These large basins collect cold air drainage and are dominated by spruce-fir forests, swamps, and bogs. This habitat is similar to areas found north of Vermont in Canada and supports several boreal forest species of wildlife including spruce grouse, gray jay, black-backed woodpecker, rusty blackbird, and mink frog. Moose are common in this region and the spruce-fir forests are critical overwintering habitat for white-tailed deer. Canada lynx and American marten have recently returned to portions of this remote region.

RESOURCES

Austin, J. A., C. Alexander, E. Marshall, F. Hammond, et al. 2013. *Conserving Vermont's Natural Heritage: A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife, and Biological Diversity.* 2nd edition. Montpelier, VT: Vermont Fish and Wildlife Department. http://www.vtfishandwildlife.com/library/maps/Community_Wildlife_Program/complete.pdf

Thompson, E.H. and E.R. Sorenson. 2005. *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*. Lebanon, NH: The Nature Conservancy and the Vermont Department of Fish and Wildlife. http://www.vtfishandwildlife.com/books/Wetland,Woodland,Wildland/_0i_to__xi_frontmatter.pdf

3. HABITAT CONCEPTS AND FEATURES

By viewing single pieces of property in a landscape context, you will be able to manage your property in a way that benefits wildlife beyond your own property boundaries.

Wildlife habitat is defined as the places where animals live, find food, mates and meet their life needs. Habitat occurs at several scales, and you will need to understand each of these to properly plan for successful habitat management and conservation. As noted in the previous chapter on Biophysical Regions of Vermont, habitat occurs at the landscape scale in the form of large areas of intact, contiguous forest and the connections between these large forest blocks. Habitat also occurs at the community scale where assemblages of plants and animals come together to create a wide array of natural communities and habitat conditions such as black spruce swamps, dry oak forests, or floodplain forests, to name only a few. And lastly, it occurs at the fine scale, where individual species utilize dead trees (snags) for nesting cavities, forested seeps for foraging habitat in spring, or an area of concentrated American beech trees as an important fall feeding area. You should consider all three scales when developing a plan for wildlife habitat management, even if the plan only affects habitat conditions at the fine scale.

Wildlife do not recognize property boundaries and may require habitat that extends across lands owned both publically and privately. Habitat features such as stream corridors, ridge lines, or contiguous forests connect individual properties into the broader landscape. By viewing single pieces of property in a landscape context, you will be able to manage your property in a way that benefits wildlife beyond your own property boundaries.

This chapter will provide context and help you understand habitat concepts that are important for developing effective management plans. This will be useful when you inventory habitat conditions on your land and develop realistic management goals and objectives.

HABITAT CONCEPTS

The following information will help to define important habitat concepts:

Habitat is the natural area inhabited by an animal, plant, or other type of organism. The basic elements of habitat include food, water, and shelter. Habitat is also a function of the physical environment related to factors such as temperature, elevation, soil condition, and hydrology. Habitat occurs at several scales including the landscape scale (e.g., large areas of contiguous forest), the community scale (e.g., deep rush marshes), and the fine scale (e.g., snags and logs).

Natural communities are groups of plants and animals that recur across the landscape wherever similar environmental conditions occur, including climate, soils, bedrock type, slope, and water. Many natural communities are common in Vermont and are easily recognized, such as northern hardwood forest, spruce-fir forest, cattail marsh, and alder swamp. Others are uncommon or rare, such as clayplain forest,

northern white cedar swamp, and rich fen. Natural communities are useful for understanding the ecological variations on the land and are an important tool for planning land management and conservation. Many natural communities are closely associated with the habitat needs of specific wildlife species. For more information on natural communities, see examples in **Chapter 5, "Managing with a Focus on Natural Communities"** and in **Resources** at the end of this chapter for Thompson and Sorenson's *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*.

Here are a few examples of strong associations between natural communities and wildlife species in Vermont:

- Spruce grouse rely on lowland spruce-fir forests and interspersed black spruce swamps.
- Timber rattlesnakes use warm talus slopes for critical basking and hibernacula habitat.
- Bicknell's thrush and Blackpoll warbler rely on Vermont's high-elevation montane spruce-fir forests.
- Several species of rare and common dragonflies and damselflies occur only in poor fens and dwarf shrub bogs with some open water.
- Hemlock forests are one of the most important forest types providing winter cover for white-tailed deer.

Species diversity is the number of species, subspecies, and genetic variants of animals, plants, and other organisms in a given area. Promoting **native species** is an important component of any management plan along with protecting those that are rare regionally and statewide.

Some nonnative **invasive species,** such as house sparrows and European Starlings, are abundant near human habitation and compete with native birds for habitat. Invasive nonnative species are a serious threat to wildlife, habitats, and ecosystems in Vermont. Some invasive plants, such as honeysuckle, buckthorn, and purple loosestrife can be introduced by poorly planned land management activities. You should make every effort to remove these and other nonnative species if they become established. For more information, see "Saving Our Open Space: Effects of Urban Sprawl" in **Resources**.

Structural complexity refers to the variation of size and age classes and spacing of trees (both living and dead, standing and down) and other plants. Increasing the structural complexity of forested habitats, for instance, can increase the diversity of wildlife that use an area because it creates more fine-scale habitats within the forest.

Even- and uneven-aged forest conditions are important factors to consider when planning for forest wildlife habitat management. Even-aged forest habitat refers to forest habitat where the majority of the trees within a stand, habitat or area of interest are generally the same age. Even-age management is an important objective for developing habitat for species such as ruffed grouse, American woodcock, chestnut-sided warbler, and snowshoe hare, among many others. Uneven-aged management, on the other hand, refers to forest habitat where there is a wide distribution of ages among the trees in a stand, habitat or area of forest. This condition is important for many forest-interior songbirds such as scarlet tanager, black-throated blue warbler and oven bird. Following clearing or other forest disturbance, a forested area will regenerate as an even-aged forest, with most trees within 10 years of age of each other. In an old forest, individual trees die and create openings; in turn they are replaced by new

Natural communities are useful for understanding the ecological variations on the land and are an important tool for planning land management and conservation

or suppressed trees that grow up in the opening, resulting in an uneven-aged forest. Silvicultural techniques can be used to produce either an even-aged or an uneven-aged forest. In the absence of natural events such as fire and blowdowns, silvicultural techniques such as patch cuts may be appropriate to increase the diversity of species and ages of trees within a larger forested area and create patches of early successional habitat to mimic natural gap formation and encourage species associated with early successional forest. The book, *More Than a Woodlot*, provides an excellent overview of these concepts and how to apply them to forest habitat management.

Forest fragmentation is a condition caused by breaking up large forested blocks into smaller, isolated forested areas, often surrounded by residential development, commercial development, or agricultural (e.g., row crops). Many wide-ranging species, such as black bear and moose, need large areas of unfragmented forest habitat and this should be considered in your management plan. Forest interior songbirds, such as the hermit thrush — the Vermont State Bird, are affected by fragmentation due to increased rates of nest predation and parasitism associated with the fragmentation. For more information, see the link for Threats to Vermont's Natural Heritage in **Resources**.

Rare, threatened, and endangered species are species of plants, animals, and fungi whose populations are low or are at risk of becoming extirpated or extinct. Species listed as "threatened" or "endangered" are legally protected under Vermont's Endangered Species Law or the Federal Endangered Species Act. In both cases, the laws prohibit harming or disturbing the listed species. Many of these species occur in specialized habitats or uncommon natural communities, or have experienced significant habitat loss over time. Rare species (those with low population levels) have less legal protection, but they still provide an important contribution to species diversity in Vermont. The ANR Natural Resources Atlas (see **Resources**) is a web-based GIS mapping tool that provides access to information on the approximate location of rare, threatened, and endangered species.

A Buffer is a designated area surrounding an important habitat feature, such as a stream or wetland, in which the integrity of the plants and soils are protected. Buffers reduce the impacts of activities occurring outside the area. Buffer width and specific management practices within a buffer will vary with the habitat feature being protected. Buffers incorporated for forest management don't always assume a hands-off approach and certain habitat benefits can be realized through careful management of trees within buffers (e.g., creating snags, providing downed woody material as habitat). Some buffers provide important habitat functions in and of themselves, such as riparian habitat along rivers and streams that provide nesting and feeding habitat for northern orioles, yellow warbler, and wood ducks as well as travel corridors between larger areas of habitat for black bear, otter and mink.

If you suspect that a rare, threatened, or endangered species may occur on your property, please contact the Vermont Fish and Wildlife Department. The department can provide specific management guidance to help you protect these important species on your property.

FINE-SCALE HABITAT FEATURES

The following information will help to define important habitat features.

Lakes, ponds, rivers and streams are aquatic habitats that are essential for many species of fish and wildlife. To protect aquatic habitats from erosion, bank slumping, sedimentation, and loss of shade, buffers should be established along the edges of these aquatic habitats. Buffers should be largely undisturbed, naturally vegetated areas extending from the edge of the aquatic habitat feature. While buffers should always be treated with great care, there may be instances where active management is important such as when dealing with invasive species, pathogens, pests, and overall forest health concerns. Fisheries and wildlife biologists in the Vermont Fish and Wildlife Department can help you plan for the conservation of these important features. Buffers should be applied to both sides of stream channels and, in the case of wetlands, around the perimeter of the wetland.

In addition to protecting water quality and aquatic habitat, buffers also provide nesting and brooding cover for birds and travel corridors for bobcat, fisher, otter, and other wildlife that depend specifically on wetland and stream habitat. Although buffer widths and dimensions will vary depending on the conditions of the aquatic habitat or other features, in general, maintaining a relatively wide buffer will maximize those wildlife benefits as well as other ecological benefits such as streambank and lakeshore stabilization. Most streams require a minimum of 50 feet for a buffer to protect the aquatic functions. However, to protect the wildlife functions along a stream corridor, it is often necessary to protect a buffer width of up to 660 feet. For more information on buffers and how to plan for appropriate widths see **Chapter 14 "Riparian Habitat Management**."

If possible, the ideal buffer strip should extend at least 100 to 300 feet from water. It is important to be realistic when establishing buffers and understand that it can limit certain management activities. If the landowner has an interest in timber production as part of their habitat management plan, it may be necessary to find room to accommodate those interests.

Wetlands include swamps, marshes, bogs, and seasonally flooded areas which are extremely important to wildlife. The Vermont Wetland Rules regulate activity within wetlands and within a buffer zone around any wetland that provides significant functions and values (including wildlife habitat) as designated by the Wetlands Section of the Department of Environmental Conservation. Buffer zones are also recommended for any wetland that is determined to provide important wildlife habitat functions, including small forested wetlands. While the Vermont Wetland Rules typically require a 50-foot buffer around wetlands, many species will benefit from larger buffers. For instance, American bitterns require wetlands with buffers greater than 300 feet from development to avoid displacing those birds from suitable nesting and feeding habitat. Beavers may search out food supplies several hundred feet from a wetland.

In areas where agriculture is in close proximity to wetland habitats, fencing can restrict livestock from damaging plant stems and roots. Keeping livestock away from wetlands helps to prevent manure from contaminating water with nutrients that cause algal blooms that reduce the value of wetlands for a wide array of wetland dependent wildlife.

Some buffers provide important habitat functions in and of themselves, such as reparian habitat along rivers and streams that provide nesting and feeding habitat for northern orioles, yellow warbler, and wood ducks as well as travel corridors between larger areas of habitat for black bear, otter, and mink.

In terms of the overall landscape in Vermont, open habitats are a smaller percentage of the landscape and merit attention when you are planning for habitat management.

Naturally occurring logs, branches, and stumps in and around wetlands provide important basking, feeding, and refuge sites for turtles, frogs, and snakes. Cedar, locust or other rot-resistant wood are all excellent choices for constructing waterfowl nest structures, rather than using chemically treated wood. For more information on wetland management, refer to **Chapter 25, Waterfowl** and **Chapter 12, Wetland Habitat Management.**

Springs and seeps are small wetlands usually found within forested habitats. The shoots that emerge there in early spring provide an important source of food for many species of wildlife, as well as a reliable source of water and succulent plants during the summer. These features are also an important source of cold water for streams and rivers, and play an important role in maintaining aquatic habitat for species such as brook trout.

Vernal pools are temporary woodland pools that are especially important to breeding salamanders and frogs because, unlike in other wetlands, fish that eat eggs and larvae are absent in these pools. When standing water is absent, vernal pools can be detected by land depressions with matted, water-stained leaves. In general, a 100-foot buffer is recommended to protect these habitats from ground disturbance and to maintain shade. An additional limited buffer is recommended to 600 feet, in which timber is carefully harvested to minimize soil disturbance and at least 70 percent crown closure of the tree canopy is maintained. Avoid placing landings, roads, slash, or operating heavy machinery in the pool habitat in order to avoid destroying the conditions of the pool. Refer to **Chapter 12, Wetland Habitat Management** for more specific information on management recommendations.

Openings are both naturally occurring and man-made. These areas — such as beaver meadows, meadows, and rocky outcrops — all provide important wildlife habitat. While not every species may use these openings, they are a valuable habitat for many species. Maintaining these areas where they already occur is a great habitat management technique. Avoid creating openings where they will fragment large areas of forest in order to minimize the effects of predation and nest parasitism to nesting forest interior songbirds, minimize the risk of wind damage to forest stands, and minimize the risk of weed and invasive plant invasion.

These sort of open habitats are an important condition for many types of wildlife such as eastern towhee, golden-winged warbler, American woodcock, bobcat. In terms of the overall landscape in Vermont, open habitats are a smaller percentage of the landscape and merit attention when you are planning for habitat management. Location is critical when planning for this type of habitat and must be considered in the broader context of landscape habitat conditions to ensure that the location is suitable and appropriate to manage for these habitat conditions. Keep in mind that if you're enrolled in UVA, the creation of large openings, generally 20 acres or more, will likely require amendments to your UVA plans.

Mast trees, such as oak, beech, hickory, and apple, provide many species with critical sources of nutritious food. Species that are attracted to mast crops include chipmunks, evening grosbeaks, turkeys, ruffed grouse, deer, squirrels and bears. Because "hard" mast trees like oak and beech don't produce viable seeds until at least 25 years of age, preserving mature trees is important. Beech trees with bear claw marks are a clear indication that those trees have a reliable history of nut production. Cutting away shrubs and other trees that are crowding and shading apple trees is a good way to extend the productive life of these important "soft" mast trees. Other soft mast sources include cherries, mountain ash, blackberries, and raspberries. For more information on managing mast habitat, see **Chapter 20, "Black Bears"** and **Chapter 10, "Apple Tree and Soft Mast Shrub Management"** within **Part Three: Managing for Production of Wildlife Food Resources**.

Heron rookeries are home to great blue herons, which often nest in colonies ranging in size from a few nests to hundreds. You can recognize these rookeries by the presence of large stick nests typically found in trees on islands, wetlands, or hillsides. Rookeries may be used for decades or even centuries; rookeries in dead trees flooded by beavers persist for shorter periods of time than rookeries in live trees. Intact trees and uncontaminated adjacent wetlands or shallow waters are important. If nests are disturbed, herons may desert their individual nests or the entire rookery, or young birds that are alarmed may fall from the nests to their death.

Different kinds of buffers are recommended for protecting heron rookeries:

- A *primary* buffer zone of 300 feet from the outermost nest trees in a rookery should exclude tree harvesting, roads, trails, and building construction year round and should exclude hiking, hunting, fishing, and camping outside the nesting period. Do not allow human intrusion to occur between the March 15 and August 1 nesting period.
- A *secondary* buffer zone from 300 to 650 feet from the rookery perimeter should exclude sand or gravel extraction, land clearing, and construction of permanent structures or roads. Other activities to avoid

Beech trees with bear claw marks are a clear indication that those trees have a reliable history of nut production.

Try to leave two or more large den trees per acre within 300 feet of lakes and ponds to accommodate cavity-nesting ducks and other larger cavity users.

between March 15 and August 1 are temporary road construction, timber harvesting, and ATV use. To be clear, this area does not preclude timber harvesting, but those activities should be timed appropriately and planned and implemented to avoid impacting the hydrology of the habitat. Existing farming operations, including maple sugaring and the use of existing paths by non-motorized traffic, are unlikely to result in adverse impacts at this distance during the nesting season.

- You might also consider a *tertiary* buffer zone 650 to 1300 feet from the rookery perimeter. Construction of small buildings, temporary roads, and timber harvesting may be feasible outside the nesting period.

Raptor nest trees are home to forest hawks and owls. To protect the large stick nests of these birds, provide buffers around the nest trees during timber harvests. Avoid harvesting timber within the buffer during the nesting season (typically April through June). The buffer should be equal to or greater than the height of the tallest tree within 20 feet of the nest. Be sure to drop all harvested trees away from the nest tree.

Avoid creating large openings or clearcuts within 300 feet of a raptor nest to avoid isolating and exposing it to predators. An isolated raptor nest tree is more vulnerable to predators such as raccoons, which may force raptors to abandon these nests. When large areas are cut, leaving some large trees or clumps of trees for perches and future nest trees is important. You can do this by designating one or more trees 12 inches or greater in diameter at breast height per acre wildlife trees. These trees need not be high-quality timber, and culling trees with profuse branching may be appropriate.

Den trees and snags are living or dead upright trees with cavities or dead limbs that provide important habitat for a variety of birds and mammals. These trees are especially important to wildlife, especially when located near water. Among the many wildlife species that benefit from dead and dying trees are some of Vermont's now rare bats who use the loose bark and cavities to roost. Standing dead trees may also pose a risk to human safety, so you should consult with a professional forester or wildlife biologist who is familiar with the Vermont Occupational Safety and Health Administration's guidelines on logging before planning a harvest in or near unsound trees. To address safety issues, consider clustering cavity and snag trees in areas such as riparian zones and wetlands, and away from access roads and trails. If a den tree or snag must be felled for safety reasons, leave the material on the ground as important downed wood habitat.

To recognize trees that provide cavities used by wildlife for dens, look for broken-off tops and large branches, old scars, conks, and existing cavities. Hardwood trees with cavities closer to the top of the tree are ideal. When possible, leave a selection of different diameter den trees for cavity-using wildlife. Tree cavities near open water, including some wetlands, will also be used by wood ducks, common goldeneyes, hooded mergansers, and common mergansers. Try to leave two or more large den trees per acre within 300 feet of lakes and ponds to accommodate cavity-nesting ducks and other larger cavity users.

Snags, or standing dead trees, may also serve as den trees. They provide perches and feeding sites for insect-eating birds such as woodpeckers, nuthatches, and black-capped chickadees, and feeding as well as resting sites for some snakes. Try to retain as many of these trees as possible while observing human safety concerns. When snags are infrequent or absent in a forest, consider girdling trees or leaving unhealthy trees to eventually become snags.

Live trees showing signs of reduced vigor, broken limbs, or scars may be good candidates for replacement snags. This may be especially important in young stands. To maintain the maximum number of downy woodpeckers in the northeast, the U. S. Forest Service reported that four snags of 6-inch diameter or greater should be maintained per acre. Guidelines in Maine use this same ratio as a "rule of thumb" for den trees and snags combined for all wildlife, but suggest maintaining one tree greater than 18-inch diameter, two trees 14- to 18-inch diameter, and three trees 6- to 14-inch diameter per acre when circumstances allow. As with many management prescriptions, your personal analysis of the on-site situation is very important in deciding what makes the most sense. Exceeding these recommendations will likely benefit wildlife, and providing fewer snags will likely reduce the wildlife habitat benefits.

Try to leave six or more snags with 15 inch or greater diameter within 300 feet of openings, ponds, and lakes. Snags near openings may be used as hunting perches by the Eastern bluebird and red-tailed hawk. Snags near open water, even those with small diameters, may develop cavities used for nesting by tree swallows. All snags and den trees have wildlife value, but larger snags can provide for a wider range of wildlife species and may provide more wildlife value for longer periods of time.

All snag and den trees have wildlife value, but larger snags can provide for a wider range of wildlife species and may provide more wildlife value for longer periods of time.

The following are management recommendations for maintaining and managing for den trees and snags:

- Manage for at least six cavity, snag, and/or decadent, living trees per acre on average, with one exceeding 18-inch diameter breast height (DBH) and three exceeding 16-inch DBH.
- Leave trees that have cavities of varying sizes and are located in the upper trunk of the tree. Also, give priority to hardwood trees with cavities, rather than softwood, as they remain intact longer.
- To address safety issues, consider clustering cavity and snag trees in areas such as riparian zones and wetlands and away from access roads and trails. Over time, these will become downed woody material and provide additional, long-term ecological benefits to fish, wildlife, and forest health.

Exposed perches are large exposed branches and isolated or tall trees that provide perch sites for raptors and other birds. However, brown-headed cowbirds, a grassland species that invades forests to lay their eggs in the nests of other birds, benefit from perches offering good vantage points to scan the area for nests. Avoid leaving exposed perches when forests are fragmented and there is nearby farmland that provides grassland habitat and livestock feed for cowbirds.

In most situations you should leave naturally downed trees where they fall.

Stumps provide feeding and den sites for small forest-floor animals such as mice, voles, shrews, chipmunks, squirrels and even weasels, which will use the decaying root system as ready-made tunnels.

Course woody material, such as logs, provides display sites for ruffed grouse, travel lanes, and important microhabitats for small mammals, salamanders, frogs, fungi, and overall forest health (nurse logs for tree regeneration). Larger logs provide greater value to wildlife because they persist for many years. In particular, large hollow logs used as shelter or denning habitat only come from large, standing hollow trees, so the best way to create this habitat is to let large trees grow, decay, and fall naturally. Fallen trees, decomposing logs, bark slabs, and slash all serve as important habitat features for small mammals, salamanders, snakes, and nesting wild turkeys.

Trees that naturally fall into wetlands, lakes and ponds, and rivers and streams are beneficial to wildlife for shade and cover. In most situations you should leave naturally downed trees where they fall. In contrast, slash and other logging debris can create negative impacts to aquatic habitats. Leaving an unmanaged buffer zone along a waterbody will provide an appropriate amount of downed wood for the aquatic habitat.

Brush piles, including treetops and other slash, provide roost and nest sites for some birds, cover for chipmunks and rabbits, and may provide a safe spot for a newborn fawn. Animals as large as bears use brush piles in remote forested areas for denning. In addition to providing habitat values, slash returns nutrients to the forest floor as it decomposes and can retard over-browsing by "locally over-abundant" deer and moose. However, slash in streams can disrupt water flow and cause sedimentation problems and should be removed during timber harvest operations.

Rock piles such as stone walls, old foundations, and other exposed rocks provide cover and microhabitats used by small, forest-floor mammals, reptiles, and amphibians. Some of these sites are valuable as cultural resources in addition to their wildlife habitat value.

RESOURCES

Austin, J. et al. 2004. "Threat to Our Natural Heritage" in *Conserving Vermont's Natural Heritage*. 2nd ed. Waterbury, Vermont.

Bryan, R.R. 2007. *Focus Species Forestry: A Guide to Integrating Timber and Biodiversity Management in Maine*. Falmouth, ME: Maine Audubon.

DeGrasf, M. Yamasaki, W.B. Leak, A.M. Lester. 2005. *Landowner's Guide to Wildlife Habitat – Forest Management for the New England Region*. Lebanon, NH: University Press of New England.

Flatebo, G., C.R. Foss, S.K. Pelletier. 1999. *Biodiversity in the Forests of Maine – Guidelines for Land Management*. 1999.

Long, S. 2012. *More Than a Woodlot: Getting the Most from Your Family Forest*. Corinth, Vermont: Northern Woodlands.

Thompson, E. H. and E. R. Sorenson. 2005. *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*. Lebanon, NH: The Nature Conservancy and the Vermont Fish and Wildlife Department. Web version: http://www.vtfishandwildlife.com/books/Wetland,Woodland,Wildland/_0i_to__xi_frontmatter.pdf

U.S. Department of Agriculture. Natural Resources Conservation Service. "Artificial Nesting Structures." http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=25175.wba

Vermont Agency of Natural Resources ANR Natural Resources Atlas. http://anrmaps.vermont.gov/websites/anra/

—.Vermont Fish and Wildlife Department. 2000. "Saving Our Open Landscape: Effects of Sprawl on Wildlife."

—. Department of Environmental Conservation. "Vermont Wetland Rules." http://www.watershedmanagement.vt.gov/rulemaking/docs/wrprules/wsmd_VWR%207-16-10.pdf#zoom=100

PART TWO:
Forest Habitat Management

4. FOREST MANAGEMENT: AN OVERVIEW

In Vermont today, nearly 76 percent of the landscape consists of forest. This is in stark contrast to the Vermont landscape of the 1800s when vast areas were cleared for farming and agriculture. Over time, the Vermont landscape has returned to a largely forested condition a wide variety of forest community types. This matrix of forest habitats, which comprises large and small patches connected by streams, wetlands, fencerows, and forest strips, creates valuable wildlife habitat. On the landscape scale, these forest blocks provide habitat for many, if not most, of Vermont's native wildlife. In fact, the Vermont Fish and Wildlife Department developed a GIS layer that illustrates the extent of forest blocks throughout Vermont and serves as a valuable tool for understanding the location, distribution, size and condition of these habitat features at a broad scale (see Figure 4.1).

Forest habitats consist of many different tree and plant species that comprise an array of natural communities ranging from the large and widely distributed northern hardwood forest to the scarce and sensitive clayplain forest. To fully benefit from the natural community concept for habitat management, you will need to gain an understanding of a wide range of plants and animals that interact together to create the various communities. While not essential for managing habitat for wildlife, this understanding of, and appreciation for, natural communities will allow your land to achieve greater benefits from your management actions.

Fine scale habitat elements, such as snags, stumps, dead and down trees, rock piles, concentrated areas of nut-producing trees (mast) such as red oak and American beech, are all part of the larger forest habitat conditions and are especially important to identify and understand for effective forest habitat management.

Many of the important concepts covered in **Chapter 3, "Habitat Concepts and Features,"** will help you make informed decisions about how to manage an area of forest to benefit wildlife habitat. For instance, if you wish to develop old forest conditions (a condition that is uncommon in Vermont), you may elect to increase the density of large diameter live and dead trees within the management area. This in turn requires that consideration be given to retention of snags and down woody material for perch sites, cavity trees, drumming logs, and escape cover. It also requires careful attention and patience to increase the density of large diameter trees. Old forests are highly complex forest systems and provide important wildlife habitat values not found in mid-aged forests, such as habitat for American marten, a rare wide-ranging carnivore that is native to Vermont, and dependent upon mature, old, softwood forests with diverse structure consisting of standing and down woody material that attracts and supports the small mammals it preys upon.

This chapter provides information on some important forest habitat conditions that should be considered when developing a management plan for forest wildlife habitat. Many useful and important references on this subject exist and you are encouraged to supplement the information in this guide book through the recommended readings referenced at the end of each chapter in **Resources**.

To fully benefit from the natural community concept for habitat management, you will need to gain an understanding of a wide range of plants and animals that interact together to create the various communities.

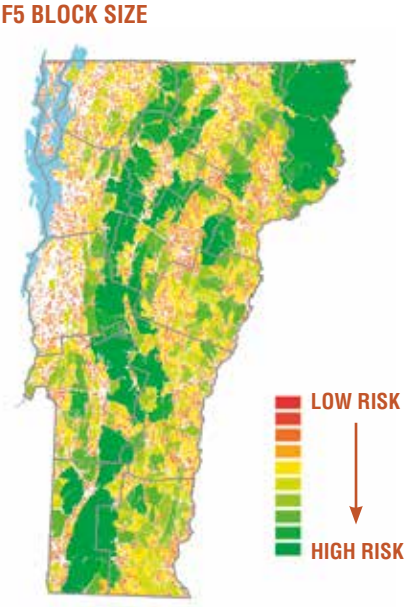


Figure 4.1 Forest blocks in Vermont as seen through GIS

5. MANAGING WITH A FOCUS ON NATURAL COMMUNITIES

When managing significant natural communities, you should strive to maintain or enhance the characteristics of the specific natural community type.

A natural community is an interacting assemblage of plants and animals, their physical environment, and the natural processes that affect them. As these assemblages of plants and animals repeat across the landscape wherever similar environmental conditions exist, these repeating assemblages can be described as natural community types. The Vermont Fish and Wildlife Department (VFWD) recognizes 89 upland and wetland natural community types in Vermont. Natural communities provide a powerful tool for describing the landscape, developing sound management plans for land, determining conservation priorities, and increasing our understanding of the natural world.

Each community type is ranked based on how rare it is in Vermont as well as its size and condition. There are common and widespread natural communities, such as northern hardwood forest and alder swamps; uncommon types such as northern white cedar swamp and dry oak forest, and rare types such as clayplain forest and poor fen. Rarity ranks are based on the number of known examples of the type, the total area occupied by the type, and the degree of threat to the type. For example, calcareous riverside seep is a very rare wetland community type that occurs only in areas of calcareous ground water seepage over flood-scoured bedrock river shores, whereas northern hardwood forest is a common community type that occurs throughout the state at elevations below 2,500 feet.

The VFWD evaluates each natural community type by comparing it to other known examples of that natural community type. This makes it possible to objectively compare all the known examples of a type (such as poor fen) to decide which examples are the best and most important for conservation and which would benefit from specific management. This quality rank for each natural community is based on an assessment of the size and current condition of the natural community, and the landscape context in which the community occurs. Each of these three factors is assigned an appropriate weight based on the specific community type and its characteristics. Large size, condition reflecting minimal human disturbance, and a surrounding landscape with intact natural communities and minimal fragmentation are all factors that contribute to a highly ranked natural community.

Based on the rarity of the natural community type and the quality of each natural community example, the VFWD considers a subset of the best examples of each natural community type to be state-significant. Significant natural communities are mapped in the Department's Natural Heritage Database (see **Resources** for a link to more information).

Natural communities vary in their sensitivity to human alteration. Some communities are very dependent on specific conditions such as shade or water flow, and even small changes to these conditions from timber harvesting or ground disturbance can lower the value of the community for native wildlife. Other communities, such as cliffs and talus or widespread forests, are more resilient.

When managing significant natural communities, you should strive to maintain or enhance the characteristics of the specific natural community type. For rare, ecologically sensitive, and very small natural communities, such as a rich fen, or a red maple-black gum swamp, this will usually mean taking a passive approach and buffering the area

➤ PAGE 24

from active management. In some cases, removing nonnative invasive species or planting native species can improve the value of a degraded natural community. For significant examples of more common and larger natural communities, such as northern hardwood forest, you should have ample opportunity to balance natural community conservation with active management. To maintain or enhance ecological integrity, include forest management practices that favor native species and structural characteristics of mature natural communities, for example, allowing natural processes such as tree death and blowdown, removal or control of invasive exotic species, and restorative planting of native species.

RESOURCES

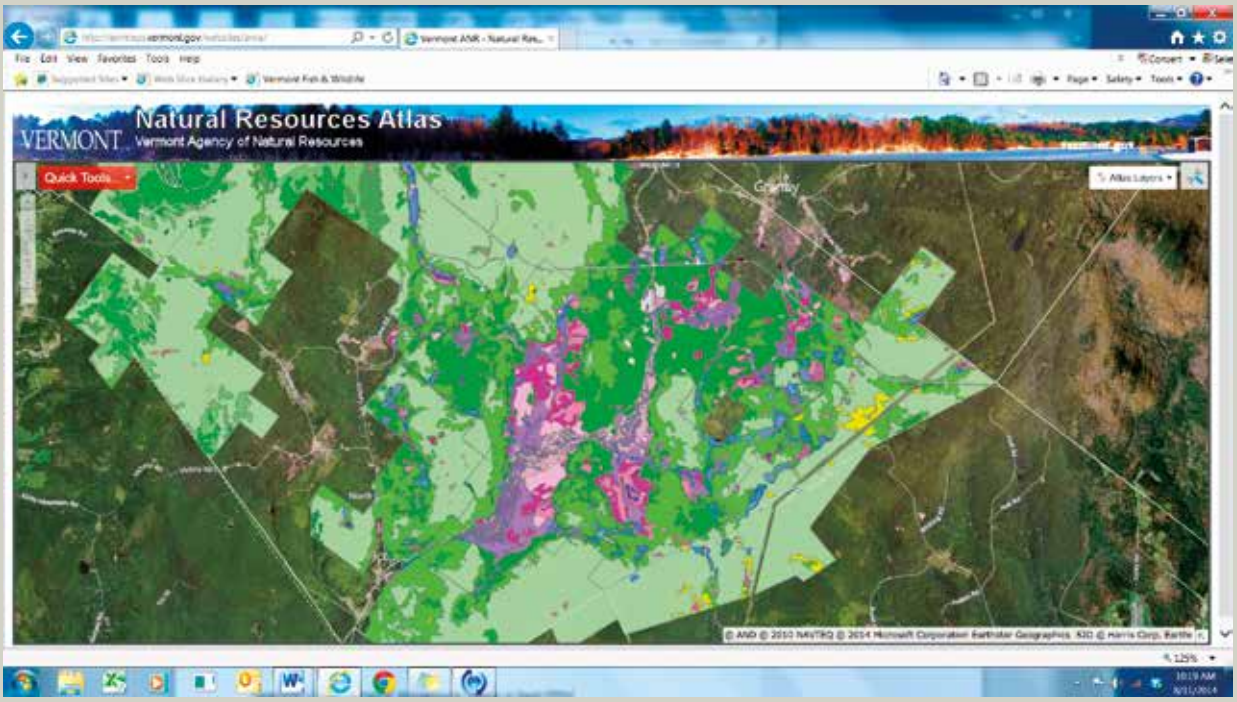
Thompson, E.H. and E.R. Sorenson. 2005. *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*. Lebanon, NH: The Nature Conservancy and the Vermont Department of Fish and Wildlife.http://www.vtfishandwildlife.com/books/Wetland,Woodland,Wildland/_0i_to__xi_frontmatter.pdf

Maine Inland Fish and Wildlife. 2008. *Biodiversity in the Forests of Maine: Guidelines for Land Management*. Orono, ME: University of Maine Cooperative Extension.

Vermont Fish and Wildlife Department Natural Heritage Database. http://www.vtfishandwildlife.com/nnhp_inventory.cfm

Natural communities provide a powerful tool for describing the landscape, developing sound management plans for land, determining conservation priorities, and increasing our understanding of the natural world.

Figure 5.1
Natural Community map of Victory Basin Wildlife Management Area



6. MANAGEMENT FOR FOREST SONGBIRDS

Managing local forests to improve habitat for forest birds can greatly improve breeding, nesting, and feeding habitat for many migrant and resident birds.

Vermont supports roughly 200 species of breeding birds—one of the highest diversities in the United States. Approximately three-quarters of these birds rely on forests for all or part of the breeding season. Among them are the American woodcock, ruffed grouse, barred owl, red-shouldered hawk, pileated woodpecker, scarlet tanager, red-eyed vireo, northern parula, black-throated blue warbler, ovenbird, wood thrush, and — Vermont's State Bird — the hermit thrush. Vermont's forests are especially important for many species of birds, which rely on the state and New England for a large portion of their breeding habitat (for example, Bicknell's thrush and American redstart).

Since widespread forest clearing in the 1800s and early 1900s, Vermont's forests have regrown to cover about 80 percent of the state, and more interior forest habitat is probably present in Vermont now than at any point in the last 150 years. During recent decades some species of forest birds have increased in population (such as golden-crowned kinglet and hermit thrush), while others have undergone worrisome declines (including wood thrush and American woodcock).

Managing local forests to improve habitat for forest birds can greatly improve breeding, nesting and feeding habitat for many migrant and resident species. Whether you want to manage your forest to help conserve birds — or just to enjoy their color and liveliness — there are many ways you can improve forest habitats for birds.

KEEP FORESTS AS FORESTS

Keeping forests intact is possibly the most important way Vermonters can support forest birds. Habitat loss and fragmentation are among the most urgent threats to Vermont's forest birds. This is because large patches of forest which are not "fragmented" by roads, buildings, or large openings tend to support more forest birds, and the birds living there produce more offspring than birds in smaller, fragmented forests.

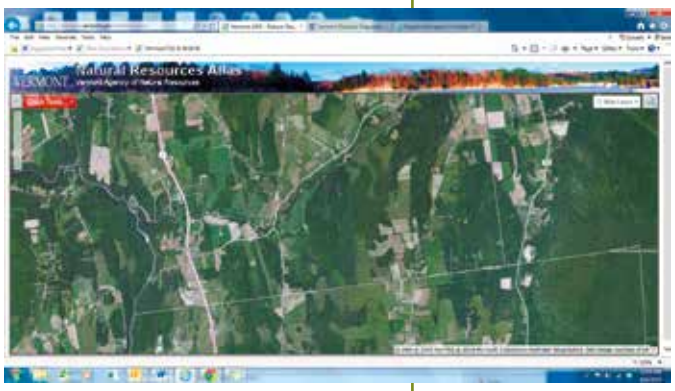


Figure 6.1 Fragmented forest
Small and fragmented forests have less value for forest birds.

An opening in a forest such as a road, field, or house lot alters the environment of the forest for more than 200 meters from the edge. Sunlight, wind, humidity, plants, insects, and predators can all change. For example, small (< 30 acres) and fragmented forest patches may support more predators such as raccoons, skunks, and domestic cats and the nest parasite brown-headed cowbird — all of which threaten forest birds.

Maintain Interior Forest

To avoid fragmenting existing forest, limit the creation of new openings (e.g., roads, fields, house lots) and place any openings near existing roads and development, preserving intact forest in the largest blocks possible. Maintaining the quality of forest habitat for songbirds is important. Quality forest habitat for many songbirds provides sufficient space, cover, food and water to allow the myriad of birds to successfully breed, rear young, find food, and avoid predators. For more information on this topic see "Foresters for the Birds Toolkit" – http://vt.audubon.org/foresters-birds.

Plan in Your Town

Find out if birds and wildlife have been considered in your town plan and zoning ordinances. Many resources exist to assist towns in incorporating wildlife into their plans, consider starting with the Vermont Fish and Wildlife Department's Community Wildlife Program or the Vermont Natural Resources Council's Sustainable Communities Program (see **Resource**s for links).

CREATE DIVERSE FOREST HABITATS

A complex forested landscape with many habitats generally supports more species than a less complex forest with few habitats. Knowing this, habitat diversity within forests can be created by increasing their complexity in two ways: increasing the ***horizontal structure*** and ***vertical structure*** of the forest.

Horizontal structure: Habitats across the landscape

The mix of different types and ages of forests across a landscape is called horizontal structure. Walking in a northern hardwood forest in early summer, you will likely notice red-eyed vireos and ovenbirds, while walking in a spruce-fir forest you might see yellow-bellied flycatchers and Swainson's thrush, and in a forested wetland you might spot white-throated sparrows and wood ducks. These different types of habitats across the landscape support a variety of forest birds. Some steps to follow include:

Maintain different types of habitat. Plan your forest management to maintain or enhance the diversity of habitats (e.g., hardwood, softwood, wetland, and floodplain) on your property. Given the average property in Vermont is 40 acres, it's becoming increasingly more difficult for a single landowner to provide a diversity of habitat conditions. Again, this speaks to the importance of working in collaboration with your neighbors to maximize the benefits of forest and habitat management on a larger scale.

Use buffers for streams and wetlands. To protect sensitive and valuable streams and wetlands, designate limited- or no-harvesting areas along the borders of streams, rivers, lakes, ponds and wetlands. These areas where terrestrial and aquatic habitats come together tend to support many types of birds, mammals, reptiles, amphibians, insects and plants. They are used as travel corridors by many wildlife species such as otter and black bear, and offer important feeding areas for moose, waterfowl, wood turtles, and many songbirds. Protecting the health of the forest conditions along these aquatic features is an important management strategy.

Ensuring a variety of *ages* of different cover types on the landscape provides additional diversity for birds. Most of the forested landscape in Vermont consists of forests that are 40 to 100 years old. Older, more mature forests are rare in Vermont. Old forests, more than 100 years in age, tend to have high levels of woody material on the ground, cavity trees, and other features that create complexity within the forest that then provide important habitat for many species of wildlife such as pileated woodpecker or American marten.

In addition, there are regions of Vermont (e.g., Bennington County) where young forest (less than 15 years old) is limited. Young forest provides important breeding habitat for many species as well as foraging

Young forest provides important breeding habitat for many species as well as foraging areas for many forest birds, especially before and during migration.

Figure 6.2 Unfragmented forest
Large, intact forests with wetlands and small openings are ideal for forest birds.

areas for many forest birds, especially before and during migration. Providing these underrepresented age classes can benefit forest birds:

Manage for old forest. Designate set-aside areas that will, over time, become old forests, and other areas that will be actively managed to develop the characteristics of old forest.

Manage for young forest. If your landscape is mostly forested, but less than 5 percent of the area is young, regenerating forest, consider creating 1- to 5-acre patches of young forest habitat where appropriate. Young forest should nonetheless remain a small component of heavily forested landscapes. However, in a landscape of small forest patches or fragmented forests, creating young forest areas will not benefit forest birds. Creating quality young forest habitat requires a detailed knowledge of the soils, trees and land use history of your land. Not every patch of forest can be treated by cutting trees and expecting quality young forest habitat conditions. Results from such management actions depend on many factors, including what trees are currently present. If the objective is to create young forest to attract ruffed grouse, American woodcock and chestnut-sided warblers, you are unlikely to be successful by creating patch cuts in a northern white cedar stand, for instance. On the other hand, if your forest has mature aspen, birch, hophornbeam, alder, you have a good opportunity to establish quality young forest conditions to achieve your objectives. (See **Chapter 7, "Shrubland and Young Forest Management"** for more information.)

Vertical structure: Layers within a forest

The diversity of vegetation layers within a forest, from ground to tree canopy, is called vertical structure, and it is an important element of forest habitat for many birds. Different species of birds forage and nest within the different layers of a forest — for example, in one patch of forest, you might find nesting pairs of oven birds in the leaf litter on the ground, black-throated blue warblers in a thick understory of hobble bush (1 to 5 feet up), blue-headed vireos in the mid-story (6 to 30 feet up), and scarlet tanagers in the canopy of mature northern hardwood forest (above 30 feet).

After extensive clearing and logging, however, most of Vermont's forests have not had time to develop the complex layering that supports bird diversity. You can, however, enhance each vertical layer of your forest to increase its value for birds by:

Promoting a healthy leaf litter layer. Reduce erosion and compaction by harvesting in winter on snow cover. Maintain canopy cover to prevent litter from drying out. Do not introduce earthworms, which are nonnative and can quickly deplete a forest of its leaf litter.

Promoting a vigorous understory and mid-story. If needed, work with a forester or wildlife biologist to release seedlings and saplings from surrounding competition and create gaps to allow light to the understory.

Promoting a vigorous canopy. If needed, work with a forester or wildlife biologist to use thinning or crop-tree release to focus growth on healthy canopy trees. Retain and grow some large-diameter trees (over 2 feet in diameter), which can be particularly important for a variety of wildlife.

Monitoring and controlling invasive plants. In addition to outcompeting desirable, native plants, nonnative species may have less nutritional and nesting value to forest birds. For more information www.vtinvasives.org.

Apart from the living layers present in a forest, dead and dying wood creates critical habitat for many species of forest birds. Snags (standing dead trees) and partially decayed live trees are valuable perches and provide nest sites for cavity-nesting birds such as woodpeckers, chickadees, and owls. Dead wood on the ground is also valuable to birds for display sites (for

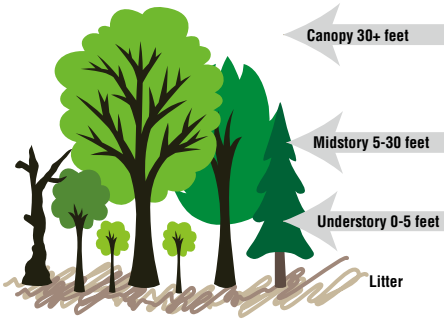


Figure 6.3
Comples vertical layers provide excellent forest bird habitat. (Don't overlook the snag!)

example, for ruffed grouse drumming sites), cover (to forage safely on the ground), and food (many insects live in dead wood). To ensure quality habitat for birds on your land:

Maintain or create snags and downed wood. Maintain at least six snags or cavity trees per acre, with one larger than 18 inches, two larger than 16 inches, and four downed trees per acre. Leave slash (branches, limbs, etc.) on the forest floor. Residual material from timber harvests provide valuable habitat for ground nesting songbirds, as well as other wildlife.

BEYOND BIRDS

Management for forest birds can brighten the woods with their colors and songs. It also benefits many other wildlife species. Forests that support a variety of birds, with complex horizontal and vertical structure, dead and downed wood, and trees of all ages and sizes, also provide habitat for a wide variety of forest interior wildlife species. These might include frogs and salamanders, forest pollinators such as bumblebees, numerous small mammal species including many bat species, and even rare species like the American marten.

NEXT STEPS

Before you proceed further with your plan, consider getting a second opinion and double-checking available resources. To do so:

- Use a forester or wildlife biologist to help inform your forest management plan. Have a forester or wildlife biologist create and implement your forest management plan, including goals and actions to benefit forest birds.
- Consult with professionals. Contact your county forester or biologists with Vermont Fish and Wildlife Department, Audubon Vermont, or the Natural Resources Conservation Service for more guidance and information on programs that provide technical and financial assistance.
- Read "Managing Your Woods with Birds in Mind." This free guide is an invaluable resource for landowners and managers created by Audubon Vermont and the Vermont Department of Forests, Parks, and Recreation. (see **Resources**).

RESOURCES

Audubon Vermont and the Vermont Department of Forests, Parks and Recreation. *Managing Your Woods with Birds in Mind*.http://vt.audubon.org/sites/default/files/documents/landowner_packet_5-2012_small.pdf

—. Foresters for the Birds. http://vt.audubon.org/foresters-birds

Bryan, R.R. 2007. *Focus Species Forestry: A Guide to Integrating Timber and Biodiversity Management in Maine*. Falmouth, ME: Maine Audubon.

DeGraaf, R.M., M. Yamasaki, W.B. Leak, A.M. Lester. 2005. *Landowner's Guide to Wildlife Habitat – Forest Management for the New England Region*. Lebanon, NH: University Press of New England.

U.S. Department of Agriculture. Natural Resources Conservation Service. Forest Birds Info Sheet.http://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1243274&ext=pdf

—. Sustainable Communities Program. http://www.ric.nat.usda.gove/sustainable-communities.

Vermont Fish and Wildlife Department. Community Wildlife Program. http://vtfishandwildlife.com/cwp-home.

Forests that suport a variety of birds, with complex horizontal and vertical structure, dead and downed wood, and trees of all ages and sizes, also provide habitat for a wide variety of forest interior wildlife species.

7. SHRUBLAND AND YOUNG FOREST HABITAT MANAGEMENT

Shrubland habitat and young forest differ in vegetation types and food and cover they provide, as well as where and how they are maintained on the landscape.

"Shrublands" and "Young Forest" are terms that apply to areas that are transitioning to mature forest and are dominated by seedlings, saplings, and shrubs with interspersed grasses and forbs (herbaceous plants). While some sites such as wetlands, sandy sites and ledge areas can support a relatively stable shrub cover, most shrub communities in the northeast are successional and change rapidly to mature forest if left unmanaged.

Shrub and young forest habitats in Vermont provide important habitat functions for a variety of wildlife including shrubland birds, butterflies and bees, black bear, deer, moose, snowshoe hare, bobcat, as well as a variety of reptiles and amphibians. Many shrubland species are in decline due to loss of habitat. Shrubland bird species in Vermont include common species such as chestnut-sided warbler, white-throated sparrow, ruffed grouse, Eastern towhee, American woodcock, brown thrasher, Nashville warbler, and rarer species such as prairie warbler and golden-winged warbler. These habitat types are used by 29 Vermont Species of Greatest Conservation Need.

Figure 7.1
Regeneration-shrub habitat. Courtesy of John Gobeille, VFWD.

While small areas of shrub and young forest habitat can be important to some wildlife, managing large patches of 5 acres or more provides much greater benefit to the wildlife that rely on the associated habitat conditions to meet their life requirements. Birds such as the chestnut-sided warbler will use smaller areas of young forest, but less common species such as golden-winged warbler require areas of 25 acres or more.

AREA SELECTION

To practically meet the needs of wildlife that use shrub and young forest habitat, maintain 8 to 10 percent of the property in shrub or young forest cover. As with managing other habitats, managing for young forest or shrubland habitat can be challenging. In order to promote diversity in the age structure of your forest and wildlife therein, maintain large areas of older forest stands with snags and various sizes of coarse woody debris on the forest floor to provide important cover for small mammals, salamanders, and insects. Cut selectively to promote trees that are important food sources for wildlife such as beech, oak, cherry, and apple.

Working with your county or consulting forester or wildlife biologist can help. Professional foresters and wildlife biologists can provide expertise in managing young forests that will improve

Figure 7.2
American woodcock are in decline due to lack of habitat. Courtesy of Kathy Declar, VFPR.

your chances for successfully accomplishing your habitat management goals, especially since selecting appropriate sites with appropriate tree and shrub species is essential for realizing your wildlife goals.

Shrubland habitat and young forest differ in the vegetation types and food and cover they provide, as well as where and how they are maintained on the landscape. For these reasons the habitat types will be considered separately.

SHRUBLAND MANAGEMENT TECHNIQUES AND GUIDELINES

Shrubland is generally considered to be an area with high sunlight exposure that remains permanently in a state of low plant cover, ranging from herbaceous plants to woody plants less than 20 feet tall. Shrublands are nature's pantry, providing myriad insects, fruits, seeds and nuts. Dogwoods, serviceberry, chokecherry, blueberry, blackberry, hazelnut, mountain holly, and wild cranberry are just a few of the numerous shrubs of high value to wildlife. Although a few shrublands such as alder stands are naturally stable, most shrub areas will require periodic brush mowing to maintain their productivity and prevent invading tree species from converting them to forest.

A shrubland is initially established on a forested site by cutting all trees, either by harvesting marketable timber and requiring all smaller trees to be cut, or by contracting a mechanical rotary cutter to chop up non-merchantable trees. Repeated brush hogging every 5 years will suppress the establishment of tree species, allowing shorter-lived shrubs to colonize the area. Old fields can become shrublands by allowing shrubs to become established naturally over time, then mowing as noted above. The primary goal of shrubland management is to concurrently have half of the area in mature, fruit-producing shrubs, and the other half in younger, regenerating shrubs. This is accomplished by brush-hogging half of the shrubland area every 5 years.

Shrubland size is determined by the your goals, parcel size, and surrounding landscape. For example, if you have a keen interest in conservation of golden-winged warblers you may be able to maintain a 10-acre shrubland adjacent to a neighbor's 10-acre shrubland, paralleled by a 5-acre power line corridor. The combined 25 acres is sufficient for golden-winged warblers, and will benefit many other birds and mammals.

A practical approach for most landowners is to manage 10 percent of a parcel as shrubland by identifying one or more areas to be maintained in permanent shrub cover. Each site should be no smaller than an acre in size (the minimum size of value for many wildlife species), but ideally as large as possible up to 10 percent of the acreage. For example, a 20-acre parcel would have 2 acres in shrubland, and half of the 2 acres would be mowed every 5 years.

YOUNG FOREST MANAGEMENT TECHNIQUES AND GUIDELINES

Young forest is an area dominated by seedlings and saplings of forest trees, such as aspen, maple, oak, pine, spruce, etc., rather than shrubs. Although young forest provides wildlife with many of the same structural habitat elements as shrubland, it differs in two important ways: the dense cover is a temporary condition that quickly transitions to a more open forest as the trees mature, and it normally provides much less forage in the form of fruits and seeds. Young forest is allowed to transition to a mature forest over time, rather than maintained through periodic mowing.

When evaluating property for opportunities for young forest management, first identify any stands with "pioneer" species — the first to colonize old field sites — such as pin cherry, aspen, alder, and paper or

Although young forest provides wildlife with many of the same structural habitat elements as shrubland, it differes in two important ways: the dense cover is a temporary condition that quickly transitions to a more open forest as the trees mature, and it normally provides much less forage in the form of fruits and seeds.

grey birch, as these sites will produce young forest and shrub habitat very quickly. If creating young forest habitat adjacent to a utility line corridor (power line, pipeline) or existing shrub or young forest cover (old field or orchard, alder or shrub wetland, etc.), this will increase the functional size and benefits of the new habitat patch. If no "pioneer" tree stands exist, then consider stands that have a high percentage of poor quality trees or have been "high graded" (i.e., all the best trees have previously been harvested). They are also good candidates to regenerate and manage as young forest habitat Keep in mind that not all sites that have been "high graded" or have a high percentage of poor quality trees should be considered for creating young forest conditions. These may also be suitable sites for developing old forest conditions if given enough time, patience and careful stewardship, as discussed previously. Finally, forest stands with high quality trees that have been identified by a professional forester as mature (ready for harvest) can produce income, wood products, and young forest habitat. Regenerating these stands should only be done under the guidance of a forest management plan prepared by a professional forester or wildlife biologist in order to protect water quality, ensure re-stocking with desirable tree species, and meet the landowner's expectations for wildlife, recreation, and aesthetics.

MECHANICAL AND MANUAL MEANS

The most common management practice for creating young forest habitat is through manual (chainsaw/brush saw) or mechanical cutting of trees and shrubs. Exactly how and when the cutting takes place is critical to successfully regenerating the desired trees on the site. For example, aspen, paper, and grey birch, and northern hardwood stands are efficiently regenerated into young forest by cutting all stems greater than 2" in diameter (clearcutting), in a patch a least ½ acre in size but preferably larger, up to 10 acres. However, an oak or pine forest must be harvested in a manner which carefully retains some shade, (a "shelterwood" cut), timed carefully with the deposition of seeds from the retained trees. Spruce and fir are regenerated in strips or a patchwork of small patches, ½ to 2 acres in size in a manner which accounts for the presence of existing seedlings and saplings. Cedar and hemlock stands are very difficult to regenerate back to the same species, and are not recommended as suitable stands for the creation of young forest habitat. Obviously, proper forest management is complicated and requires application of the science of silviculture by a professional forester or wildlife biologist. Additional information is available in the Resources listed at the end of this chapter, and landowners are strongly advised to consult a professional prior to initiating any work on the ground.

CHECKERBOARD AND NATURAL CUTS

There are a number of ways to configure and distribute new patches of managed young forest. Checkerboard patterns are a traditional approach that can be effective for creating a diversity of interspersed patches of young forest. Alternatively, patches can be configured in a more convoluted fashion. This more closely mimics a natural disturbance and if done correctly can create higher value young forest habitat due to increased forest edge. Figures 73a and b illustrate these approaches.

CUTTING ON ROTATION

For landowners with large parcels (50 acres or more), managing a number of large blocks (5 to 10 acres) on a rotation is ideal to keep 10 percent of the parcel in forest under 15 years of age. This provides for a wide variety of wildlife species that use open areas, such as bluebirds, to species that use thick vegetation, such as the ruffed grouse. When possible, management should occur outside the primary nesting season of April 15 to August 1. Cutting should be done in winter when the ground is frozen and plants are dormant. This will encourage vigorous sprouting of trees, provide an increased number of stems per acre, and protect the soil and duff layer from disturbance. The duff layer, including the organic soil horizon and leaf litter, provides important habitat for salamanders and feeding areas for species such as rufous-sided towhees.

Figure 7.3 a and b
Checkerboard pattern (top) and a more convoluted pattern (bottom) can create a diversity of interspersed patches of young forest.

NEXT STEPS

- In order to promote diversity in the age structure of the forest, maintain large areas of older forest stands with snags and various sizes of coarse woody debris on the forest floor to provide important cover for small mammals, salamanders, and insects.
- Select areas to create young forest ("regenerate") carefully, in order to retain trees that are important food sources for wildlife such as beech, oak, cherry, and apple.
- Do not cut snags, den trees, or nest trees.
- Leave downed logs and brush piles on the forest floor. These will be used by many different species.
- Follow Vermont Department Forests, Parks and Recreation harvesting guidelines designed to maintain water quality and protect rare or fragile areas or species.
- Control any invasive species such as common buckthorn or honeysuckle prior to harvest because they will likely spread and may dominate the site; continue to monitor for invasive species after harvest.
- Monitor for the presence of invasive plants such as honeysuckle and buckthorn and remove them as the opportunity presents itself.

RESOURCES

Northeast Habitat Technical Committee. "Managing Grasslands, Shrublands, and Young Forest Habitats for Wildlife: A Guide for the Northeast." http://www.wildlife.state.nh.us/Wildlife/Northeast_Hab_Mgt_Guide.htm

U.S. Department of Agriculture, Natural Resources Conservation Service. "What is Early Successional Habitat?" http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081109.pdf

—."What are Shrubland Birds?" http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081112.pdf

—."American Woodcock: Habitat Best Management Practices for the Northeast."http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=28815.wba

The Young Forest Project website. www.youngforest.org

➤ PAGE 33

8. DEER WINTERING AREA MANAGEMENT

Shrubland habitat and young forest differ in vegetation types and food and cover they provide, as well as where and how they are maintained on the landscape.

White-tailed deer in Vermont live near the northern limit of their range in eastern North America. To survive, deer must use very specific winter habitat when severe climatic conditions become a threat.

Areas that are used year after year by deer seeking winter shelter are called *wintering areas* or *deer yards*. These areas consist of two basic habitat components. The *core range* is often characterized by concentrations of softwoods with high crown closure. This provides numerous thermal and microclimatic advantages to the deer such as reduced snow depths, less wind, increased daily mean temperatures, and increased relative humidity. South-facing slopes are often preferred yarding areas because they receive more direct solar radiation. The second component consists of mixed hardwood and softwoods adjacent to or within the core range, which provide accessible browse.

Stand maturity, canopy closure, crown shape and height, tree species, slope, and aspect are all important factors that determine whether or not deer will overwinter in a particular area. For example, snow cover is often melted or blown off steep, south-facing slopes in southern Vermont, and deer may be found on these slopes even when very little softwood cover is available.

Figure 8.1
Sample of a map of deer wintering areas

IDENTIFYING WINTERING AREAS

Physical evidence of use by deer is the best way to determine whether an area can be considered a wintering area. The most obvious indications of very recent deer use include tracks, trails, and droppings. Other less obvious, though more reliable, indicators of deer wintering area are the more permanent signs of deer use on vegetation, such as browsing and bark scarring.

Browsing on young, small diameter twigs and branches should be evident, even though the intensity of deer browsing may vary from site to site. Seedlings and saplings in heavily used areas have a deformed or "broomy" appearance. Bark scars from deer feeding can be visible to the trained eye for 20 years. Well-worn deer paths may also be evident.

Maps of currently known deer wintering areas are available from town clerks, regional planning commissions, and at each Vermont Fish and Wildlife Department district office. They are also available from the ANR Natural Resources Atlas at the link in **Resources**.

In addition, upon request, a wildlife biologist can be available to meet with resource managers and interested private landowners for on-the-ground reconnaissance of suspect areas.

WINTERING AREA MANAGEMENT

The management goal for all deer wintering areas, regardless of species composition, is to prolong the useful life of the habitat by:

- Perpetuating softwood shelter through appropriate timber harvests using single tree and small group selection harvests, focused on releasing advanced softwood regeneration;
- Maintaining deer mobility and access throughout all non-regenerating segments of the wintering area; and
- Providing preferred, accessible browse, where appropriate and without compromising the softwood cover.

In the short term, any cutting of the softwood component reduces the winter shelter value and carrying capacity of the area. Any management plan for a deer wintering area must be designed to provide a minimum of at least one-half (50 percent) of the entire wintering area to be in "functional shelter" at all times. Throughout this book, "functional shelter" is defined as softwood cover at least 35 feet tall, with at least 70 percent crown closure. It is important to recognize, however, that within a wintering area, there will be variability and not all of the habitat may meet these thresholds, yet they are still an important, functional part of the overall winter habitat. For additional information on managing deer wintering areas refer to the *Management Guide for Deer Wintering Areas in Vermont* available from the Vermont Fish and Wildlife Department offices or from the department website. See **Resources** for links.

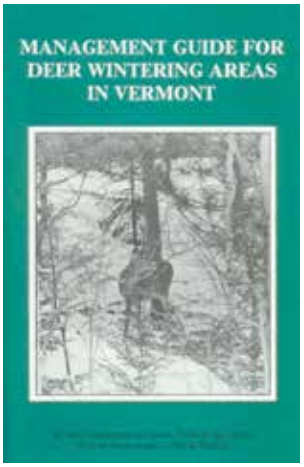


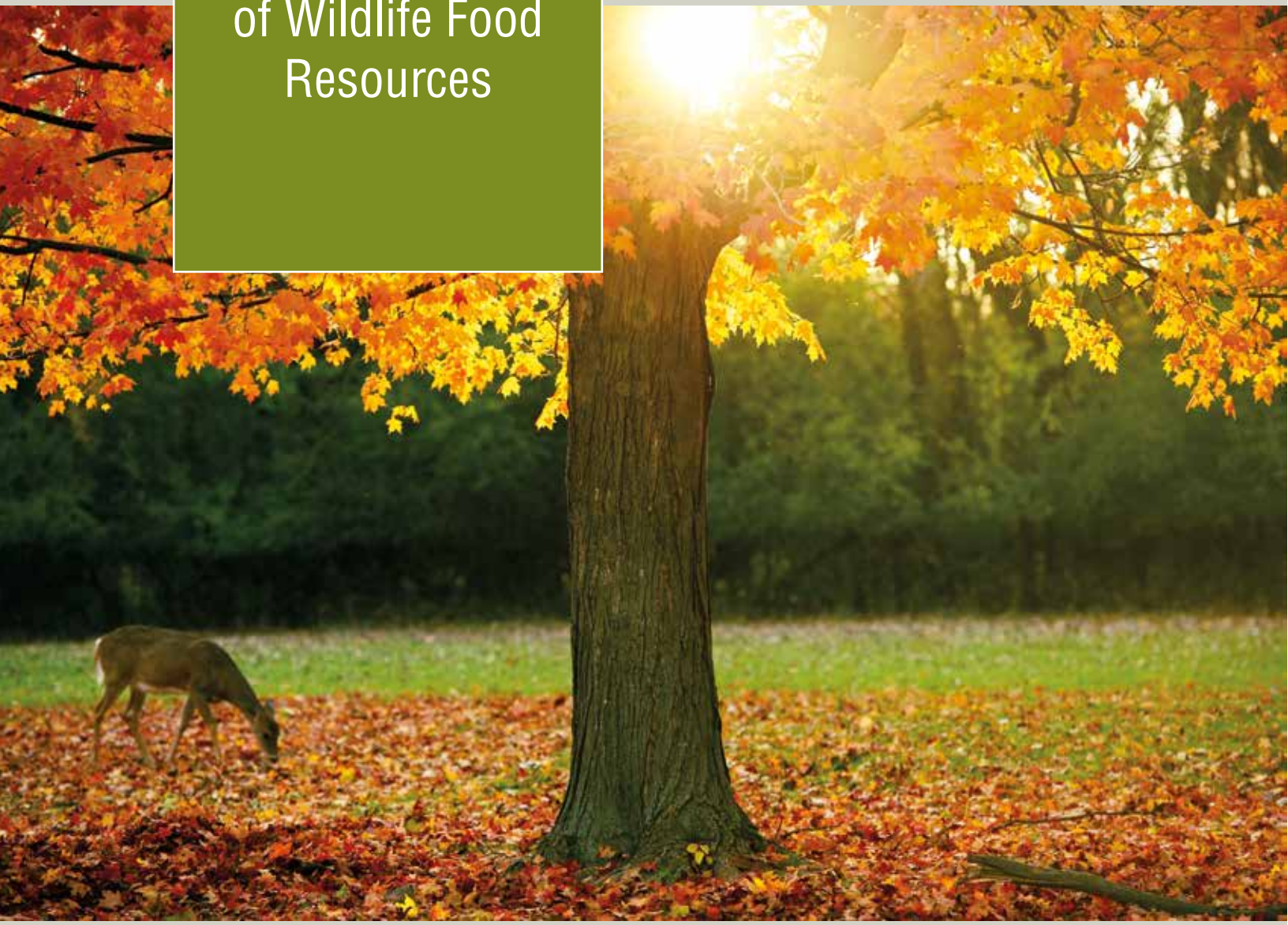
Figure 8.2
Management Guide for Deer Wintering Areas in Vermont

RESOURCES

ANR Natural Resources Atlas. http://anrmaps.vermont.gov/websites/anra/

Vermont Fish and Wildlife Department. "Management Guide for Deer Wintering Areas in Vermont." http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/Management%20Guide%20for%20Deer%20Wintering%20Areas%20in%20Vermont.pdf

PART THREE:
Managing for Production of Wildlife Food Resources



9. BEECH MAST PRODUCTION MANAGEMENT

In a mast production area the most mast is produced by dominant and co-dominant American beech trees, and some trees are much more prolific than others. Evidence of feeding by bears (claw scars on the bark, clusters of broken limbs pulled into a feeding "nest" in the fall) indicates the most prolific, consistent mast producers. Mast production begins when beech trees are about 10 inches in diameter at breast height (DBH). Forest management decisions aimed at maintaining or increasing mast production will focus on larger beech, as well as beech 6- to 10-inch DBH because of their potential for mast production or resistance or tolerance to Beech Bark Disease (BBD). Beech stand management decisions should be made in the summer, as crown condition is an excellent indicator of tree vigor and capacity to produce beech nuts. When greater than 10 percent of the crown of beech trees stressed by BBD turns yellow by midsummer, the tree has an elevated risk for mortality. When more than 50 percent of the crown is yellow and/or has died, the tree has more than a 50 percent chance of dying within a few years. Bark condition is an indicator of the tree's level of resistance or tolerance of BBD infection.

Figure 9.1
Beech trees are essential mast producers.

VERMONT AGENCY OF NATURAL RESOURCES GUIDELINES TO ENHANCE BEECHNUT PRODUCTION

Beechnuts ("mast") are a significant staple for many wild animals, ranging from small mammals to black bears, deer, turkeys, ruffed grouse and other birds. Unfortunately, many beech trees are in poor health due to beech bark disease. Vermont Agency of Natural Resources (ANR) has developed guidelines for identifying *beech mast production areas* with high potential for improvement, and recommendations for management to mitigate the impacts of beech bark disease and maintain beech mast as a significant resource on a landowner's property. The guidelines were developed for ANR lands, but are helpful for managing any land with significant beech mast production. Designed specifically for beech mast production areas, they are not silvicultural guidelines for timber production.

Based upon a synthesis of current literature and knowledge of experts in forest pathology, silviculture, forestry, and habitat management, the recommendations have yet to be field tested and proven effective as a management system. Although the individual components of the recommendations are based upon proven research (for example, mature mast trees do respond to crown release), the guidelines as prescribed have not yet been proven to produce the desired outcome. ANR will implement the guidelines at a few test sites on state lands, but as with many forestry practices it will be years before the effectiveness can be determined.

The guidelines offer a science based approach to active management of "bear-scarred" American beech stands for forest managers wishing to try an alternative to "doing nothing" in bear-scarred beech. Worse than "doing nothing" would be harvest of beech or other trees within or near bear feeding stands without the benefit of the latest research on disease resistance and mast production. The document is available for download on the Vermont Fish and Wildlife Department website, www.vtfishandwildlife.com under the title *VT ANR Beech MPA Guideline.*

SELECTING CROP TREES TO RETAIN AND ENHANCE

When making decisions on which trees to retain and enhance, consider the following factors (in order of priority):

1. *Resistant to BBD, good mast producer:* Large crown ≥10" DBH; smooth bark without any evidence of beech bark disease defects, scale, or Nectria; < 10 percent of branches are yellow or recently dead. Bear claw scarring indicates the great value of these "super beech" as mast producers.
2. *Tolerant to scale/BBD, good mast producer:* DBH ≥10", some smooth bark, raised lesions and/or blocky bark show evidence of repeatedly walling off and coping with BBD. There may be signs of beech scale. Less than 20 percent of circumference is affected by injuries affecting cambium; <10 percent of branches yellow or recently dead. Evidence of bear clawing indicates importance of these trees as mast producers.
3. *Resistant to scale, poor mast producer:* DBH ≥10" with smooth bark not showing evidence of BBD, scale or Nectria, <10 percent of branches yellow or recently dead. These ultra-smooth barked trees, about two to five percent of the beech population, are desirable to maintain for their contribution to resistance in the population via sexual reproduction.
4. *Resistance to scale and mast both unknown:* Smooth bark, 6 to 10" DBH with broad crown, <10 percent of branches yellow or recently dead. Trees are potentially resistant or tolerant, represent future crop trees, and are desirable to retain for contribution to resistance in the population via sexual reproduction. To address this and other forest health issues, you should contact your local county forester.

SELECTING TREES TO REMOVE

The objective is to release the crowns of crop trees from competition by thinning on three sides (W-N-E) and retaining trees of any species to shade and prevent sun scald on beech on the south side. When considering which trees to remove consider the following factors:

- Beech trees BBD susceptible (i.e., sunken lesions) or >50 percent yellow or recently dead crown.
- Beech trees BBD tolerant but poor mast producers, with no bear scarring.
- Any beech trees ≥6" DBH with poor crown development or severe wind snap defect.
- Any other tree species ≥6" DBH which will release crop trees on W-N-E sides.

HARVESTING GUIDELINES

As beech reproduce prolifically from root suckering, harvest operations should be conducted in winter conditions (frozen ground or greater than 12 inches of snow) to minimize injury to beech roots and trunks. Timber harvests are best conducted using tracked equipment if possible to minimize root damage. Tree species other than beech can be girdled, and not felled, to avoid damage to crop trees or regeneration. However, beech trees are not to be girdled as the tree will regenerate by sprouting before it dies, creating a dense thicket of disease prone saplings.

These recommendations are excerpted from Vermont Agency of Natural Resources (ANR) guidelines developed for identifying *beech mast production areas* with high potential for improvement, and for implementing active management to mitigate the impacts of beech bark disease and maintain beech mast as a significant resource on a landowner's property. The guidelines were developed for ANR lands, but they should help you manage any lands where beech mast production is the objective. The recommendations offer a science-based approach to active management of "bear-scarred" American beech stands for forest managers wishing to try an alternative to "doing nothing" in bear-scarred beech. Worse than "doing nothing" would be harvesting beech or other trees within or near bear feeding areas without the benefit of the latest research on disease resistance and mast production. Specifically intended for beech mast production areas, these recommendations are not silvicultural guidelines for managing beech where the primary objective is timber production, or for managing other tree species for timber where beech is destined to be unacceptable growing stock. You can find this document on and download it from the Vermont Fish and Wildlife Department website, www.vtfishandwildlife.com or see the link in **Resources.**

RESOURCES

U.S. Department of Agriculture. Natural Resources Conservation Service. "What is Forest Stand Improvement?" http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081110.pdf

Vermont Fish and Wildlife Department. "VT ANR Management Guidelines for Optimizing Mast Yields in Beech Mast Production Areas." http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/VT%20ANR%20Beech%20MPA%20Guideline%203-22-2011.pdf

Vermont Department of Forests, Parks and Recreation. "Voluntary Guidelines for Forest Management. http://www.vtfpr.org/Harvestguidelines.cfm

10. APPLE TREE AND SOFT MAST SHRUB MANAGEMENT

Prolonged periods of crowding and shading will cause a decline in the vigor of apple trees, eventually leading to death and loss of an important food source for wildlife.

Wild apple trees, along with many soft mast shrubs (hawthorn, chokecherry, dogwood, wild raisin, mountain ash, and so on) can be found scattered throughout the Vermont landscape. They provide an important source of food and cover for many species of wildlife, including white-tailed deer, ruffed grouse, snowshoe hare, cottontail rabbit, and gray squirrels. Apples or apple seeds have also been found in the stomachs of fox, fisher, porcupine, bobcat, and red squirrel. Apple trees also provide good nesting habitat for many songbirds, including bluebirds, flycatchers, robins, and orioles.

While only four species of crabapples are native to North America, none are apparently native to Vermont. Regardless, this nonnative tree is not invasive and is considered an important crop and wildlife tree. Vermont is fortunate to have an abundance of wild apple trees growing in young forests and abandoned fields. Yet, many are being lost to succession, disease, and lack of management.

Some of Vermont's wild apple trees were planted by early settlers while others have grown from seeds deposited by birds and mammals including domesticated livestock. They normally become established in clearings or on field edges, but as forests grow these trees are crowded by shrubs and shaded by other mature trees. Prolonged periods of crowding and shading will cause a decline in the vigor of apple trees, eventually leading to death and loss of an important food source for wildlife.

You can improve life span, vigor, and yield of wild apple trees and other soft mast shrubs, with some simple techniques that are commonly used by foresters, wildlife biologists, and orchardists. The most effective way to improve the productivity of apple trees and soft mast shrubs is to provide direct sunlight. To increase sunlight, cut the surrounding trees and shrubs that are competing for nutrients, water, space, and sunlight. This process of "release" removes surrounding competition and improves the crop tree or shrub's vigor and production ability.

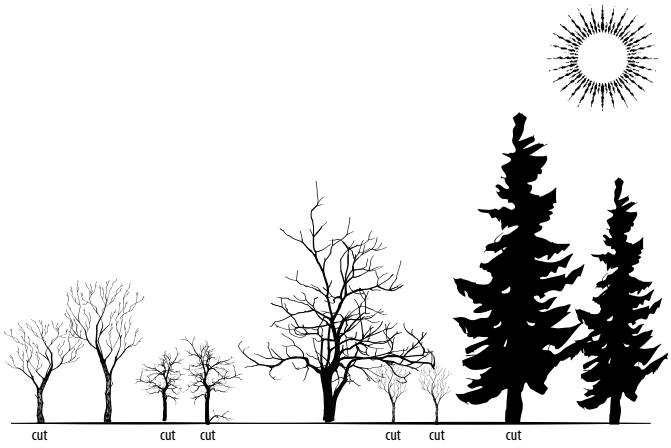


Figure 10.1 Before release and pruning.

Figure 10.2 After release and pruning.

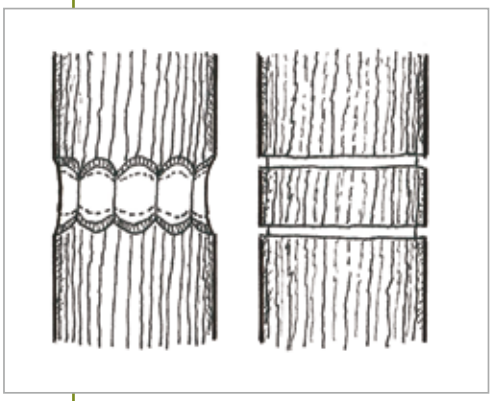
When selecting trees for release, you should consider many factors. If you choose one or two isolated trees to release, it may provide a potential food source but may have limited additional benefits. But if you select an old orchard or areas where there are numerous trees together, this will provide ample opportunities for cross pollination and early successional habitat.

When selecting trees for release, you should choose the healthiest most vigorous stems, as they have the best chance for survival. Remove any competition that is growing up into the tree, and all other stems that are growing next to or within the drip line of the apple tree's canopy (see Figures 10-1 and 10-2). With direct sunlight being the key factor to successful apple tree enhancement, release may include the removal of large trees outside of the drip line. Focus of sunlight release should be orientated to obtain the most daytime sun. Therefore release should focus on removal of competition on the south, east and western sides of the apple tree. To increase the use and value of the tree, try and leave cover on the north side of the tree. You can also girdle trees as an alternative to complete tree removal.

GIRDLING TREES

Girdling is a management technique that involves removing a tree's bark and cambium layer, disrupting the flow of nutrients from the roots to the crown. Girdling may be easier and safer on large trees and can be beneficial to wildlife because a snag (dead/dying tree) can provide feeding, nesting and roosting sites for a variety of wildlife. Here are some tips:

- Use a chainsaw or ax to cut two encircling cuts through the bark and cambium layer into the wood to a depth of 2 inches.
- The cut band between the encircling cuts should be at least 2 inches wide. ***Note:*** species such as white pine may require the removal of more wood, as pitch can act as a sealant to heal the wound and allow the girdled tree to survive. See Figures 10-3 and 10-4 for details.



Figures 10.3 and 10.4
Common girdling techniques.

PRUNING TREES

Once a tree has been properly released from the surrounding sunlight competition, pruning is the next step to successful reclamation of these wild apple trees. Pruning should be completed in late winter (December through March) or any time before bud break, while the tree is dormant. When setting up for pruning, before a cut is made, look for the "branch collar," which is a ring of tissue around the base of the branch (see Figure 10-5). Make cuts here and not flush with the main stem to ensure that proper healing of the cut can occur.

The first pruning should focus on removing all the diseased and dead limbs from the apple tree. Cut these off with a pruning saw or shears as close to the living material as possible. Cuts should be made with sharp tools to avoid nicks, stubs, tears, and splits, which can leave the tree vulnerable to insects and disease. Be sure to disinfect pruning tools before starting another tree to avoid transferring viruses or fungi. A simple solution of 1:10 bleach to water or rubbing alcohol, Lysol spray, or flaming tools can be also be effective. ***Note:*** Bleach can be corrosive to some metals.

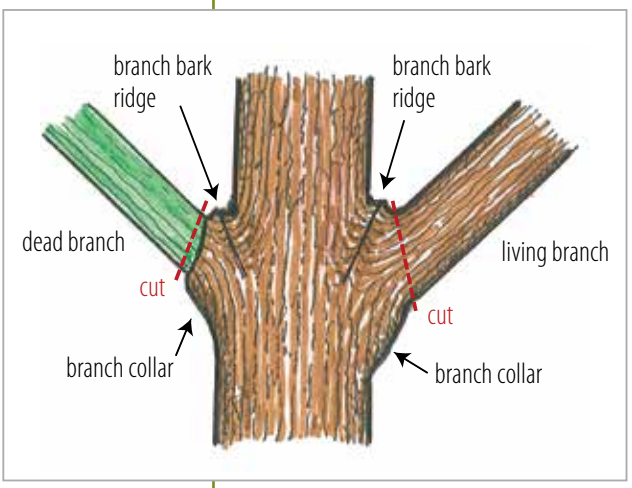


Figure 10.5
Before pruning a limb, look for the "branch collar" and make your cut here.

Once you've removed dead and dying material, pruning efforts should focus on removing limbs that are crowding out the canopy of the apple tree. In most case, the removal of one to three limbs is all that is needed to allow sunlight into the remaining canopy. As a rule of thumb, removal should be less than one-third of the overall canopy, as excess removal over stimulates shoot growth. It's always best to spread out large pruning jobs across a few years.

You should also remove branches that cross or rub to prevent areas for insects or disease to take hold. When pruning, be sure to select strong branches with wide crotch angles (near 90 degrees) to the main stem. Limbs with narrow crotch angles (less than 90 degrees) are weak and tend to break under the weight of a crop or heavy snow loads (see Figure 10-6).

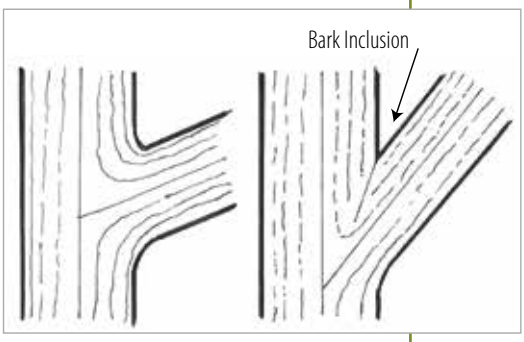


Figure 10.6
Limbs with narrow crotch angles are weak and should be pruned.

Also, remove any upright growing shoots or "water sprouts." These shoots are excessively vigorous and rarely fruit, and often occur in great numbers after "topping" (pruning large upright, or vertical branches) or "tipping" (cutting lateral branches between nodes). Minimize tipping and topping by working with the existing form of the tree rather than trying to shape the tree into the way you think it should look. Remember, trees do not have to be in perfect form to provide fruit for wildlife.

Finally, go slow. These trees are wild, may have been neglected for years, or never tended to by humans at all. Pruning apple trees too aggressively or exposing them to sunlight too quickly can shock the tree and result in poor health or death. With proper maintenance, wild apple trees can be a productive link in the food chain that will lead to years of good wildlife habitat on your land.

RESOURCES

Northeast Habitat Technical Committee. *Managing Grasslands, Shrublands, and Young Forest Habitats for Wildlife: A Guide for the Northeast*. http://www.wildlife.state.nh.us/Wildlife/Northeast_Hab_Mgt_Guide.htm.

11. WILDLIFE FOOD PLOT MANAGEMENT

Forest openings may be created artificially through tree harvest or they may occur naturally due to insect damage, tree disease and mortality, drought, flooding, tree fall, lightning strikes, ice storms, wind, and wild fires. Regardless, openings result in rapid and extensive growth of herbaceous vegetation from increased exposure to sunlight on the forest floor. This growth typically includes sources of nutritious food for some wildlife such as grasses, forbs (herbaceous plants), raspberries, and blackberries. Thus openings enhance the overall habitat value of the existing landscape by providing areas for foraging, resting, courtship displays, nesting, and brood rearing. For some species of wildlife, the presence of these forest openings is one of the most important factors in their abundance.

Herbaceous forest openings generally fall into two categories: (1) naturally regenerating openings with mixed forest grasses and forbs, raspberries, and ferns, and (2) cultivated food plots. Natural openings tend to be temporary in nature and over time they will develop into mature forest. These habitats require regular attention and management over time, so you should be careful not to create food plots that are too large for reasonable future maintenance and management. Keep in mind, however, that food plots over 1 acre in size are not eligible for UVA management plans in Vermont.

Openings as small as a 1/4 acre provide benefits to a variety of wildlife, including white-tailed deer, wild turkey, cottontail rabbit, black bears, ruffed grouse, woodcock, songbirds, owls, and some reptiles and amphibians. Larger blocks of small shrub and herbaceous habitat (e.g., 2 to 5 acres) are more effective in providing value to some species of wildlife, but you should also provide ample amounts of *edge habitat*, or transition zones between openings and forest, to maintain protective cover for larger species.

Forest openings enhance the overall habitat value of the existing landscape by providing areas for foraging, resting, courtship displays, nesting, and brood rearing.

MANAGEMENT GUIDELINES

Generally speaking, food plots should be long and irregularly shaped, and it's best to distribute them throughout your property rather than concentrating them in one area (this assumes you have sufficient space for multiple food plots). The best food plots are planted in long strips adjacent to good escape cover such as hedgerows or on the edge of forest cover. Remember to maintain adequate buffers from waterways and wetlands when tilling soil to create food plots (a minimum 100-foot buffer is recommended).

By using both annual and perennial crops you will provide a food "buffet" for many wildlife species during all seasons and enhance the natural vegetation that is already present.

As a rule of thumb, 5 percent of your property could be planted to food plots, of which 40 percent should be annuals and 60 percent should be perennials. Ideally, food plots should be at least 800 square feet and should receive approximately 4 hours of sunlight a day.

Cultivated food plots are not recommended in the woods and should be restricted to existing field edges where introduction of non-invasive, nonnative plants will not pose a hazard to forest biodiversity. Interior forest food plots should allow for natural establishment only of native forbs, berries, shrubs, and trees. You can cut these plants back periodically to maintain food value over time. Start with existing openings, such as log landings, logging roads, field edges, and old fields to reduce the time and effort required for maintenance. One of the most important first steps in establishing a food plot is to test the soil on the site you are interested in managing. Sampling and testing of the soil can help to determine what needs to be done to ensure good growth of your plantings. "Field Crop" soil test kits are readily available from University of Vermont Extension Offices that will provide you with information on measurements such as pH, organic matter, phosphorus, and potassium.

Soil pH, usually between 6 and 7, is a key factor in developing an effective food plot. If a soil test reveals that the pH is low, lime or other similar products should be gradually added to the soil, without applying too much in any given year to avoid excess runoff into streams.

PLANT SELECTION

Plant a variety of crops that target the particular species you are trying to promote. Annual crops such as corn, wheat, and rye provide a high yield in a short period of time. Wheat provides forage for grazing wildlife during the winter months and produces a beneficial seed head that is highly favored by songbirds. Annual crops left to go fallow also create good nesting habitat for birds, and waterfowl. Perennial crops such as alfalfa, chicory, and clover will re-seed, and spread, providing high-quality forage for a number of years if properly maintained. By using both annual and perennial crops you will provide a food "buffet" for many wildlife species during all seasons, and enhance the natural vegetation that is already present.

Figure 11.1
Tools used to spread seeds

PLANTING

Be sure to purchase a seed that exclusively targets wildlife rather than general agricultural seeds because most wildlife are able to tolerate higher protein levels then domesticated animals, and higher protein is the ultimate goal for planting food plots.

Spreading of the seed and fertilizer is typically accomplished using a cyclone spreader, drop-seeder, or grain drill. A single person can spread seed and fertilizer with a hand-crank spreader. Once the seed and fertilizer are spread, the mixture needs to be lightly disked or dragged into the soil. This can be done by using a shallow disk harrow behind a tractor, or by dragging a piece of chain-link fence or tree bows behind a tractor or ATV. With optimal growing conditions, you should expect to see plant growth and wildlife activity almost immediately. Consider using an exclusion cage, a wire cage that protect the plants from grazing wildlife, to serve as a gauge to see how much wildlife is using the plot and then determine how much maintenance is needed.

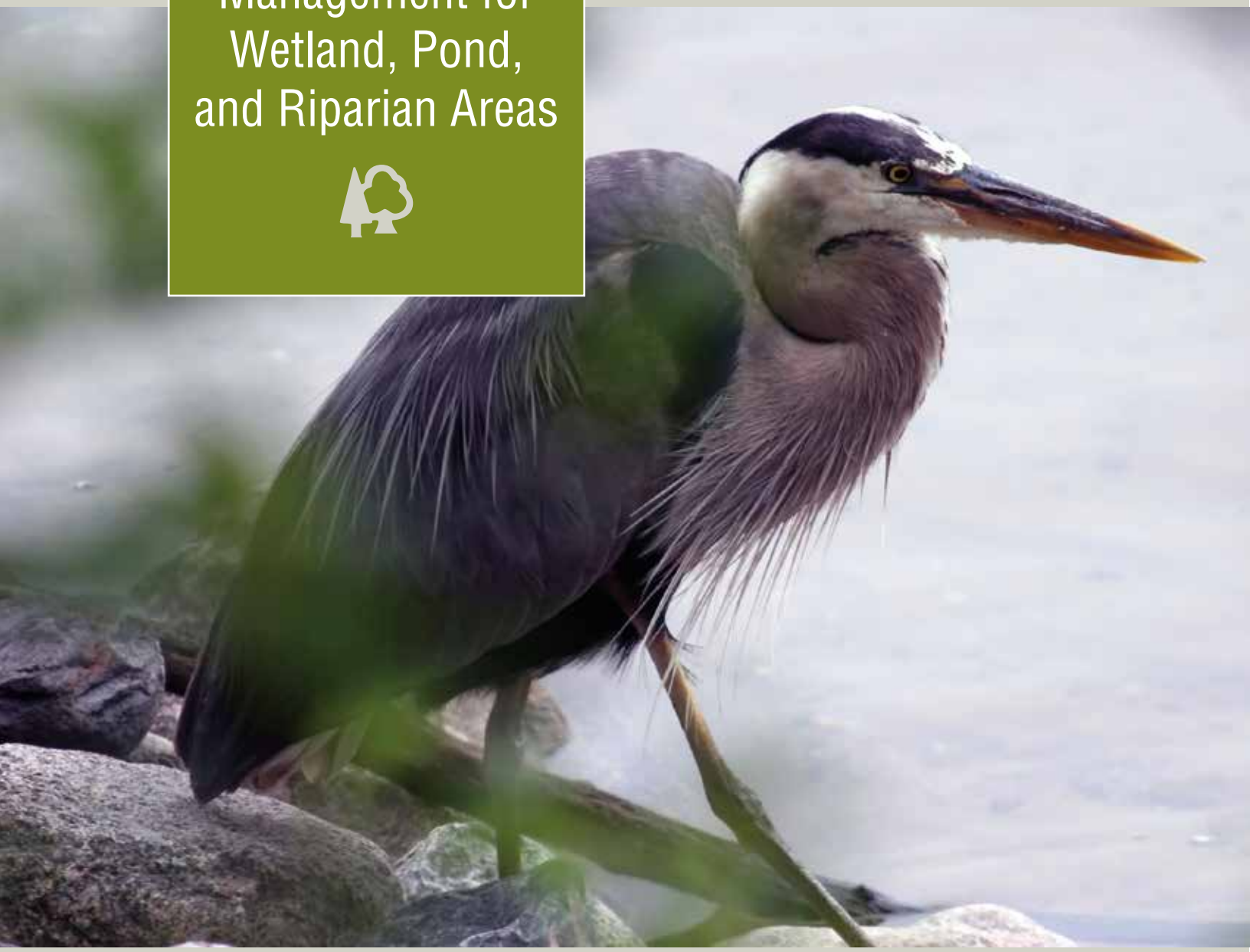
MAINTENANCE

Management of these cultivated food plots doesn't end once the seed has been planted. Many factors contribute to the prolonged success of both perennial and annual crops. For perennials, once the food plot has begun to establish and growth is well on its way, you should plan on regular high mowing two to three times during the summer months. Mowing above the lowest growth node on plants such as clover helps to keep the plants young and tender as well as provide the most protein out of your plant. Periodic mowing also works to keep competing weeds to a minimal reducing the need for herbicides.

Overall, establishing a wildlife food plot can be an enjoyable and rewarding experience. By using all available information, you will be able to create a successful and sustainable food source that wildlife will use for many years to come.

Perennial crops such as alfalfa, chicory, and clover will re-seed, and spread, providing high-quality forage for a number of years if properly maintained.

PART FOUR:
Habitat Management for Wetland, Pond, and Riparian Areas



12. WETLAND HABITAT MANAGEMENT

Wetlands are ecosystems characterized by hydric soils that support vegetation adapted to life in a wet environment. Wetland communities include the vegetated, shallow-water margins of lakes and ponds, the seasonally flooded borders of rivers and streams, and an amazing diversity of topographic settings across the landscape, including basins, seepage slopes, and wet flats. There are three characteristics shared by all wetlands. First, they are inundated by or saturated with water for varying periods during the growing season. Second, they contain wetland or hydric soils, which develop in saturated conditions. Finally, they are dominated by plant species that are adapted to life in saturated soils.

Wetlands can be grouped into the following general wetland types. *Swamps* are wetlands dominated by woody plants, either trees or shrubs. *Marshes* are wetlands dominated by herbaceous plants. *Fens* are peat-accumulating open wetlands that receive mineral rich groundwater. *Bogs* are also peat-accumulating wetlands but are isolated from mineral-rich water sources by deep peat accumulation and therefore receive most of their water and nutrients from precipitation.

WETLAND FUNCTIONS AND VALUES

Wetlands are some of the most biologically rich and diverse ecosystems that exist in Vermont, the United States and throughout the world. In Vermont, they represent a small percentage of the overall landscape (approximately five percent) and as such, must be protected for the many values they support. Generally speaking, wetlands provide a wide array of benefits including flood storage, water quality improvement, recreation, education and science, and habitat for many species of fish, wildlife, plants, and insects.

The following functions, although mentioned briefly, are important to consider when understanding the importance of wetlands on your property and help provide context for the values they may provide.

Hydrology

Frequency and duration of soil saturation are the primary factors determining the type of wetland that will develop or occur in a particular setting. For example, permanent standing water in deep-water marshes excludes most woody plants and is suitable habitat for only those herbaceous plants adapted to such a stressful environment that is created by this type of hydrology. Other wetlands are only seasonally wet or flooded, such as vernal pools or floodplain forests. These wetland habitats support a different set of plants and trees, and as a result, support different species of wildlife.

Nutrient Availability

The availability of nutrients in wetlands has a significant effect on the plants that will grow there. Fens occur in areas with calcium-rich bedrock. Many marshes receive surface water runoff, which provides a source of dissolved nutrients and minerals. In contrast, mineral poor wetlands

Wetlands provide a wide array of benefits including flood storage, water quality improvement, recreation, education and science, and habitat for many species of fish, wildlife, plants, and insects.

Wetlands also provide critical habitat for many animal groups that we know much less about, including dragonflies, butterflies, moths, beetles, and other insects.

have low nutrient availability. Bogs are especially low in nutrients. The effect on what plants occur in a wetland effects what food is available for some wildlife, or what brood-rearing habitat may be available for nesting waterfowl.

Attenuation of Flood Flows

Many wetlands, especially those that occur in basins with restricted stream outlets or in the floodplains of rivers, have the capacity to store large volumes of water generated by heavy rainfall, rapid snowmelt, or floods. These wetlands release stored water slowly back into rivers or streams or in some cases allow the water to percolate into the ground.

Surface Water Quality Protection and Groundwater Recharge

Wetlands are effective in trapping sediments and removing nutrients and pollutants from surface water runoff before that water reaches streams or lakes. The location of a wetland relative to sources of runoff and the receiving stream or lake is important in determining how effectively a wetland will protect the quality of surface waters. Groundwater discharge may be evident as seeps or springs where water comes to the surface. These wetlands have characteristic features such as stable water levels and soil saturation, defined outlet channels, and water chemistry and vegetation that reflect mineral-enriched conditions.

Fish Habitat

Certain freshwater fish species require wetlands as spawning grounds and as nursery areas for their young. Spring spawning by northern pike in the emergent wetlands adjacent to Lake Champlain is a particularly good example. Others, like black bullhead, yellow perch, pumpkinseed, and bluegill, leave open water to spawn in shallow water wetlands. Wetlands are also important for maintaining the quality of fish habitat by providing shade or discharging water from cold springs, both of which moderate surface water temperatures.

Wildlife Habitat

As previously mentioned, wetlands provide essential habitat for numerous species of wildlife. The dense vegetation found in most wetlands provides a variety of foods and also nesting sites that are relatively safe from predators. Many species, such as Canada goose, wood duck, great blue heron, muskrat, beaver, snapping turtle, and bullfrog are wetland dependent, meaning that they rely on wetlands for some or all of their life cycles. For others, such as black bear, moose, deer, wood frogs, and marsh hawks, wetlands are not primary habitat but are important for a part of their life cycle or during certain times of the year. Wetlands also provide critical habitat for many animal groups that we know much less about, including dragonflies, butterflies, moths, beetles, and other insects.

Habitat for Rare, Threatened, and Endangered Species

Wetlands occupy only five percent of the land area in Vermont, but they provide necessary habitats for the survival of a high percentage of the threatened and endangered species in the state. Examples of such wetland dependent species are Calypso orchid, Virginia chain fern, marsh valerian, common loon, spruce grouse, sedge wren, spotted turtle, and western chorus frog.

Shoreline Stabilization

Vegetated wetlands along the shores of lakes or the banks of rivers can protect against erosion caused by waves and strong currents. These wetlands dissipate wave and current energy, trap sediments, and bind and stabilize the wetland substrate. Wide wetlands with dense woody vegetation are most effective, but as can be observed in many locations along the shores of Lake Champlain, emergent wetlands such as deep bulrush marshes also contribute significantly to stabilizing the shoreline.

Beavers and Wetland Communities

Beaver alteration of wetlands is a form of natural disturbance and generally occurs in cycles that may span decades. Wetlands created and influenced by beavers are widespread and represent some dynamic and diverse wildlife habitats. These wetlands provide important habitat for a wide array of wildlife from wood ducks and Canada geese to mink, otter, and of course, beaver. Dam construction and creation of an impoundment typically kills all woody plants in the affected area and can drastically alter species composition. Over a period of years, however, beavers typically deplete their local food supply — woody species that grow near their pond — and move to other suitable habitat. Although the impoundment may persist for years, eventually the dam may fail and the pond drains. The resulting wet mud flats are colonized by annuals, then perennials, and finally woody plants after several years. All the successional wetland types created as part of this cycle are important habitats for numerous species of plants and animals.

Wetlands created and influenced by beavers are widespread and represent some dynamic and diverse wildlife habitats.

FORESTED WETLANDS TYPES

Floodplain Forests are usually dominated by silver maple, red maple or sugar maple, with abundant ostrich fern or sensitive fern. They are closely associated with river and lake floodplains and have exposed mineral soils of alluvial origin.

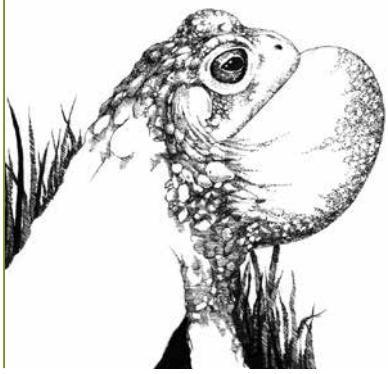
Hardwood Swamps are dominated by broad-leaved deciduous trees, but may have lesser amounts of conifers. Dominant trees may be red maple, silver maple, black ash, green ash, or black gum. Soils are mineral or organic.

Softwood Swamps are dominated by conifers, including northern white cedar, red spruce, black spruce, balsam fir, tamarack, and hemlock. Broad-leaved deciduous trees may be present but are less abundant than conifers. Soils are mineral or organic.

Seeps and Vernal Pools typically are very small and occur in depressions or at the base of slopes in upland forests. Trees in the wetland may be scarce, but there is an overhanging canopy from the adjacent forest. Seeps have abundant groundwater discharging at their margins and usually a lush growth of herbs. Vernal pools are depressions that fill with water in the spring and fall and typically have little herbaceous cover.

OPEN WATER WETLANDS TYPES

Open Peatlands have stable water tables at or near the soil surface, generally lack seasonal flooding, and mosses and liverworts are consistently abundant. Trees are generally absent or sparse, except in black spruce woodland bogs and pitch pine woodland bogs.



➤ PAGE 49

Marshes and Sedge Meadows have standing or slowly moving water with depths that may fluctuate seasonally. The soils are primarily mineral, with well-decomposed organic mucks in some cases. Herbaceous plants are dominant.

Wet Shores are sparsely vegetated wetland communities occur along the shores of rivers and lakes and are subject to seasonal flooding and scouring. The soils are mineral and include mud, sand, gravel, and cobble.

Shrub Swamps typically have significant seasonal flooding and variable soil types. Shrubs that typically dominate include speckled alder, willow, sweet gale, and buttonbush.

HOW TO PROTECT, ENHANCE, OR CREATE A WETLAND

Wetlands are one of the most sensitive and biologically rich habitats that occur in Vermont and the best way to manage wetlands is by protecting them from development or other disturbance. Establishing wide buffers around the perimeter of a wetland may be the best approach for managing to conserve the wildlife functions of the habitat. Natural wetlands, which developed across thousands of years, are hard to duplicate because of their complexity. Preserving those that are not currently altered by humans is often the best way to maintain existing functions, including wildlife habitat.

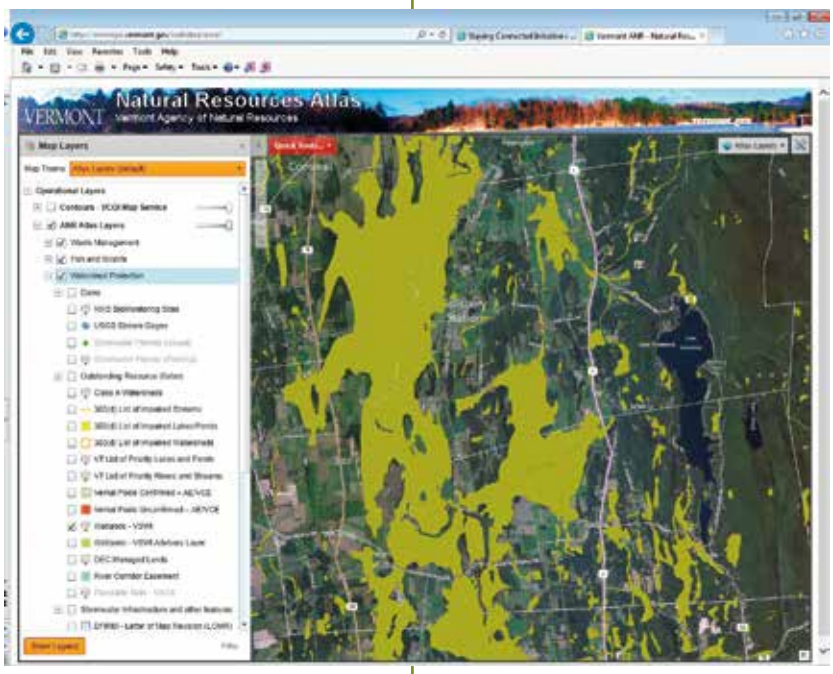


Figure 12.1
Map of wetlands as shown by the ANR Atlas

The Vermont Fish and Wildlife Department can provide detailed information on occurrences of significant wetland natural communities as well as technical assistance on wildlife habitats and use in wetlands. In addition, vernal pools are being mapped throughout the state and more information is available online or through the Vermont Fish and Wildlife Department (see Figure 12.1 and **Resources** for link).

Wetlands that have been dredged, drained, filled, or otherwise altered may offer an opportunity for restoration. Often, blocking a ditch or removing a portion of a field tile line may be all that is needed to restore water levels the support wetlands. Contact the Vermont Department of Environmental Conservation Wetlands Program or the U.S.D.A. Natural Resources Conservation Service for more information. Websites for both programs can be found in **Resources.**

"Enhancement" of an existing wetland can be difficult, and improving surrounding upland habitats is generally more effective. Enhancement efforts, however, may include removing nuisance plants and adding nest structures and other habitat improvements. To maintain and increase the size of naturally vegetated wetland buffers provides for wildlife travel corridors and screening for wildlife that are feeding and resting in wetlands. Refer to the chapters on waterfowl and beaver management for more information.

Other management options for enhancing the wildlife value of wetland habitats include:

- Install nesting structures to encourage ducks, geese or other waterfowl dependent birds to use the wetland for reproduction;
- Retain mature standing dead trees for nesting habitat for wood ducks and other cavity nesting birds and to serve as perches for raptors and other birds;
- If possible, control water levels. This is not typically the case and is not recommended without a qualified wildlife biologist. Draw advice from a biologist during the growing season to encourage prolific growth of smart weed and other native wetland plants that are of high food value to waterfowl and other wetland wildlife;
- Plant nut-producing trees, such as white oak, along the edge of the wetland to produce a valuable food resource;
- Where beavers occur, allow them to create wetlands, where appropriate — beaver influenced wetlands can become highly productive wildlife habitat;
- Retain shrub and herbaceous cover adjacent to within 1/2 mile of a wetland where it occurs — this serves as important nesting cover for mallards and other ground-nesting waterfowl that will use the wetland once their eggs hatch (delayed mowing or brush hogging is a useful approach);
- Carefully remove invasive plants such as phragmites and purple loosestrife. Follow proper protocols to prevent the seeds and roots from being dispersed to other locations.

Creating wetlands can also help wildlife, but this process may be both difficult and expensive depending on site characteristics. Wetland creation is most often done for mitigation of wetlands. Often created wetlands do not function correctly and result with failed projects due to incorrect soils, vegetation, and other factors. Wetland creation and restoration is a complicated science that involves engineering expertise and is not recommended without the guidance of an experienced wetland restoration expert. The U.S.D.A.'s Natural Resource Conservation Services and the U.S. Fish and Wildlife Service (links for which are provided in **Resources**) may provide guidance on opportunities for wetland restoration.

VERNAL POOLS

What Are Vernal Pools?

Vernal pools are small (generally less than 1 acre), ephemeral pools that occur in natural basins within upland forests. Vernal pools typically have no permanent inlet or outlet streams and have very small watersheds. These temporary pools generally last only a few months and then disappear by the end of summer, although some pools may persist in wet years.

During their dry period, vernal pool depressions may be recognized by the sparse vegetation and by stained leaves marked by seasonal high water. Vernal pools typically lack trees but are shaded by trees growing in the surrounding upland forest, with highly variable vegetation within the depression.

For vernal pools to be effective breeding habitats for amphibian populations, they must retain water for at least three months during the spring and summer breeding season in most years so that amphibians can complete their larval stage.

Why Are Vernal Pools Important?

Vernal pools are perhaps best known as breeding habitat for amphibians. Typical Vermont species that rely heavily on vernal pools for reproduction include the mole salamanders (spotted salamander, blue-spotted salamander, and Jefferson salamander), eastern four-toed salamander, and wood frog. For vernal pools to be effective breeding habitats for amphibian populations, they must retain water for at least three months during the spring and summer breeding season in most years so that amphibians can complete their larval stage.

The periodic drying of a vernal pool excludes populations of predatory fish and diving beetles that prey on amphibian larvae. Other animals use the pools as well, such as fairy shrimp, fingernail clams, snails, eastern newts, green frogs, American toads, spring peepers, and a diversity of aquatic insects. The amphibians and invertebrates found in vernal pools constitute a rich source of food for various species of mammals, reptiles, and birds such as wood ducks, mallards, black ducks, and great blue herons. Despite their small size and temporary nature, vernal pools are highly productive ecosystems. For more information on vernal pools, see the Natural Resource Conservation Service's website at the link in **Resources**.

THREATS TO VERNAL POOLS

Vernal pools and the species that depend on them are threatened by activities that alter the earth and water in and around the pool, as well as by significant alteration of the surrounding forest. Construction of roads and other development in the upland forests around vernal pools can block salamander migration. Poorly managed timber harvesting can have significant effects on vernal pools, including altering the vernal pool depression, changing the amount of sunlight and organic debris that reaches the pool, and disrupting amphibian migration routes by creating deep ruts. Even when the pool is dry, altering the depression may affect its ability to hold water and may disrupt the eggs of invertebrates that form the base of the vernal pool food chain.

MANAGEMENT RECOMMENDATIONS

Management of a vernal pool needs to include the surrounding upland habitat as well as the breeding pool. The area used by an amphibian population can be represented by three management zones: the breeding pool, a zone that extends to 100 feet around the pool, and a third zone that extends to 600 feet from the pool edge.

Breeding pool. This area includes the pool depression measured at spring high water. During dry periods, you can determine the high water mark using such evidence as watermarks on trees within the depression, water-stained, compressed or silted leaves, or an obvious change in topography at the pool edge.

Leave breeding pools undisturbed, with no cutting, heavy equipment, skidding, storage of slash or other woody debris, or sedimentation within these depressions during any season.

The 100-foot zone. Avoid land clearing, development including roads and driveways, use of pesticides, herbicides or fertilizers, and barriers to amphibian movement. Consider only light cutting or no cutting, such that at least an 80 percent canopy cover remains within this zone. Harvesting within this area should only occur on completely frozen ground in mid-winter.

The 100- to 600-foot zone. To provide adequate amphibian habitat and canopy cover, practice uneven-age forest management. Leaving some large, mature hardwoods is especially helpful for protecting and enhancing habitat. To provide adequate shading, a minimum of 60 percent of the canopy cover composed of trees at least 25 feet tall should remain intact. Try to maintain a moist forest floor with deep leaf litter and abundant coarse woody debris of various sizes. Timber harvesting should not happen during the amphibian movement period in early spring and preferably should be done on frozen ground.

Avoid using pesticides within 600 feet of a breeding pool. Avoid any activities that direct water away from a breeding pool, as this reduces the amount of water held in the depression and increases the chance that the pool will dry before amphibian larvae complete their development. Do not direct additional runoff into a breeding pool from outside its natural basin. This can change the hydrology of the pool and introduce pollutants and sediments, both of which can kill eggs and developing larvae.

REGULATIONS FOR PROTECTING WETLANDS

In Vermont, most wetlands are protected by the Vermont Wetland Rules. Some towns in Vermont have local rules that also protect wetlands. The federal Army Corps of Engineers and the U. S. Environmental Protection Agency also protect wetlands through federal laws. No wetland management should occur without a complete understanding of whether any of these laws or rules apply. Check with your town or other local government office to see if there is a wetland protection ordinance that applies to your property. State and some federal regulations can be addressed by contacting the Vermont Wetland Program in the Vermont Agency of Natural Resources — they have numerous fact sheets on their website — and the U. S. Army Corps of Engineers. Furthermore, the Natural Resource Conservation Service administers a federal wetland compliance program for landowners who participate in U. S. Department of Agriculture programs. Allow enough time for permit application and approval so as not to upset the time frame for your project.

Check with your town or other local government office to see if there is a wetland protection ordinance that applies to your property.

RESOURCES

Austin, J. A., C. Alexander, E. Marshall, F. Hammond, et al. 2013. *Conserving Vermont's Natural Heritage: A Guide to Community-Based Planning for the Conservation of Vermont's Fish, Wildlife, and Biological Diversity*. 2nd edition. Montpelier, VT: Vermont Fish and Wildlife Department.

U. S. Army Corps of Engineers. *1987 Corps of Engineers Wetland Delineation Manual*. http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf

U.S. Department of Agriculture. Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

—. Vermont Biology Technical Note 1. "Vernal Pool Habitat in Conservation Planning."http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_010203.pdf

U. S. Fish and Wildlife Services. http://www.fws.gov/

Vermont Agency of Natural Resources. Vermont Wetland Program. http://www.watershedmanagement.vt.gov/wetlands.htm

—. Vermont Wetland Rules. http://www.watershedmanagement.vt.gov/rulemaking/docs/wrprules/wsmd_VWR%207-16-10.pdf#zoom=100

13. POND HABITAT MANAGEMENT

A farm pond can provide years of enjoyment if it is carefully planned and managed.

While no current estimates exist for the number of private (a.k.a., farm) ponds in Vermont, there are undoubtedly thousands of ponds dotting the landscape with the number increasing annually. Farm ponds are built for a variety of purposes: recreation (fishing and swimming); water supply (livestock watering, irrigation, fire protection); wildlife habitat; landscape enhancement; and water storage (flood control, storm water runoff, sediment retention). A farm pond can provide years of enjoyment if it is carefully planned, constructed, and managed. However, not all uses are compatible with one another. You should think carefully about why you want to invest the money and time into constructing a new pond.

As an example, a pond that livestock use to access drinking water is not likely to provide good fishing and certainly is not compatible with swimming. Likewise, if your primary use is to support trout for recreation and food, prerequisite requirements need to be considered before breaking ground otherwise you may well be sorely disappointed by the outcome. The discussion of farm ponds in this chapter will focus on their use as fish and/or wildlife habitats.

Figure 13.1
Hamilton Pond is an example of an excavated pond.

TYPES OF PONDS

Generally ponds fall into two categories: embankment ponds and excavated ponds. *Embankment ponds* are typically constructed by damming a stream or a ravine to catch surface runoff or in some cases spring outflow. *Excavated ponds*, on the other hand, involve digging a basin below ground level allowing water to be supplied by overland runoff, the water table, a spring or drilled well (see Figure 13.1). The damming of streams, whether intermittent or perennial, can be detrimental to natural stream ecosystems — the animal and plant life they support, including public fisheries — as well as natural stream channel forming and maintenance dynamics. For example, in-stream ponds often increase stream temperatures, degrade stream habitat, and restrict the movement of trout and other aquatic populations. The construction of ponds on streams or in wetlands requires prior review and may be subject to state or federal regulation (specific contact information provided in this chapter under **Permits and Technical Assistance**).

SITE SELECTION

As in the real estate trade, the "location, location, location" axiom is equally important to proper pond design and construction. Location and size of the pond will be dictated by the lay of the land (topography), soil structure, and quantity and quality of the available water. Porous gravelly soils lacking sufficient clay can make it nearly impossible to hold water or at best maintain a desired water level throughout the year. Sites with shallow underlying bedrock can constrain excavation and prevent constructing a pond with adequate depth. While there are solutions to both situations, they can increase construction costs substantially. Your local office of the U. S. Department of Agriculture, Natural Resources

Conservation Service (formerly Soil Conservation Service) may be able to provide assistance with identifying the best location for a pond on your property.

Available water is also critical, but is frequently given inadequate attention during pond siting. Not only must water be ample without being excessive, it must come from a reliable source and be of high quality especially if your objective is to raise trout.

The placement of ponds on streams or in wetlands may have negative effects on critical fish and wildlife habitats; endangered, threatened or rare species; unique natural communities; as well as the natural physical and ecological functions of these landscape features. From a pond management perspective, on-stream ponds are faced with problems, such as retention of natural sediment load carried by streams requiring periodic costly dredging and permit acquisition and increased vulnerability to aquatic nuisance species and difficulties associated with their control. Therefore, the Vermont Fish and Wildlife Department does not recommend — and in some cases may oppose — construction of ponds in critical habitats. In addition, Vermont's Stream Obstruction Law (10 V.S.A. Section 4607) prohibits the installation of a structure that prevents fish movement, such as a rack, weir or other obstruction, unless an approval has been granted by the commissioner of the Vermont Fish and Wildlife Department. Projects where this is commonly an issue include culvert installation and dam construction or reconstruction. In cases where other agency permits are required, such as a dam order or stream alteration permit, this issue is addressed as part of that permit process. In cases where other permits are not involved, a request may be sent to the department. This is usually the case only if the stream involved is in a small watershed with a drainage area less than 10 square miles. For more information on the application procedure and required information, contact a permit specialist in the Agency of Natural Resources.

DESIGN CONSIDERATIONS

Ponds with the best potential for fish management and fishing measure at least 1 acre in size. However, most Vermont farm ponds are smaller with maximum water depths less than 10 to 12 feet. Consequently, average pond depth is much less (< 6 feet). At best such small farm ponds end up being marginal habitats for coldwater dependent fishes, such as trout, and are difficult to manage for quality size warm water fishes, such as bass and sunfish. Shallow ponds are particularly prone to warming up with lowered dissolved oxygen levels during the summer months reducing the amount of habitat needed to support trout. Oxygen depletion during the winter months can also occur after the pond ices over and snow accumulates on top shutting off light penetration. Extremely shallow ponds may even freeze to the bottom.

Additionally, shallow ponds are more vulnerable to promoting aquatic vegetation growth that is capable of spreading throughout the water body. Excessive vegetation not only interferes with other pond uses, such as swimming or aesthetics, depending on the type of plant it can add annually large volumes of organic matter to the pond. Decomposition of this organic material may lower dissolved oxygen below levels needed to support fish life, possibly resulting in periodic fish kills. So from a fish rearing viewpoint the largest, deepest pond your budget can support is the best path to follow. A minimum of 25 percent of the pond bed area should be at least 12 feet deep.

Ponds with the best potential for fish management and fishing measure at least 1 acre in size.

To manage the pond for quality or catchable size fish, you must be able to exert effective control over fish abundance.

Most ponds are excavated with shallow, low slope shore areas that can be conducive to allowing aquatic vegetation to take hold and provide wading fish-eating birds (e.g., herons) easy access to a meal. A couple design features can help address this. The pond shoreline can be excavated to have a minimum water depth of 3 feet. Or, the pond basin can be constructed with 3:1 side slopes. ***Caution:*** If the pond is also to be used for swimming, particularly by young children, deep water along the shore should not be provided for safety reasons.

Important design features of any farm pond are the built-in water control structures. These include the water control stand or drain pipe and an overflow emergency spillway. The primary function of the drain pipe is to maintain a desired pond water level during periods of normal or typical water inflow. If properly designed it also allows draining the pond to conduct maintenance when necessary. The emergency spillway on the other hand provides an alternate route to release excessive inflow such as from high spring runoff and flood events, thus lessening damage or even failure of the dam structure. Dam failure may result in loss of property, including land, buildings and roads, and possibly human life. Therefore, a professional engineer should be consulted to develop a pond design that not only will best achieve your own objectives but will be structurally sound and safe.

FISH MANAGEMENT

If your interest is managing the pond for fishing, design and environmental considerations touched upon previously will determine whether the pond is best suited for coldwater fish (trout) or warmwater species (bass, sunfish, and so on). To manage the pond for quality or catchable size fish, you must be able to exert effective control over fish abundance. This is most easily achieved in ponds stocked with trout, as most ponds do not provide all the necessary conditions for trout to reproduce naturally; therefore you control population size simply by adjusting the number of fish stocked and managing for any losses resulting from fishing, predation, or old age mortality. On the other hand, if spring seeps are present in the pond and the bottom consists of coarse sand and gravel, conditions may be suitable for natural brook trout spawning, but rarely does fish production in these situations attain problem proportions.

In contrast, bass, sunfish and other warm water fish are more apt to find habitat in the typical farm pond more suitable and thus reproduce freely. Consequently they require effective population control to maintain the appropriate balance between populations of predator fish (bass) and forage fish (sunfish, minnows). This may sound easier than it actually is, but inappropriate population and harvest management can lead to stunting (population excessively dominated by small size fish) and/or too few game fish to provide good fishing. All things considered, managing a pond for trout is simpler with more predictable outcomes than warm water species.

Trout require water that is relatively free of pollutants, is high in dissolved oxygen (> 5 ppm), and maintains cool temperatures (< 70°F) consistently throughout the year. The summer season tends to be the critical period of the year when these factors may be difficult or impossible to maintain, which results in fish stress leading to poor fish health and possible fish mortality. Surface waters, such as streams, all too frequently are not reliable water sources to deliver the required quantity of cool water to prevent excessive fish losses. Springs or a drilled well may be better options.

Trout must be purchased from a private hatchery that has been inspected for possible diseases by the Vermont Fish and Wildlife Department Fish Health Program. (For a list of in-state and out-of-state private hatcheries that are certified to sell and transport trout into Vermont contact the department at (802) 828-1000 or consult the website provided in **Resources**.)

Be aware: In Vermont it is illegal to capture fish, including trout, from the wild and transport them alive for stocking a pond without prior approval of the department to do so. Moving wild fish can introduce harmful diseases and parasites to your pond as well as to public waters threatening the health of captive fish and wild fish populations.

Table 13.1 below is intended to provide general guidance on the number of trout to stock into your pond and when. Fish numbers given are not absolute but may be adjusted to take into account your particular situation: habitat quality, the rate at which fish are harvested, and the cost of the fish. These numbers are for ponds where the fish are not provided with supplemental feed.

Table 13.1
Guidelines for trout stocking numbers of ponds

AGE CLASS	SIZE	# PER ACRE	WHEN TO STOCK	COMMENT
Spring fingerling	2–3"	200–300	April, May	Recommended only for ponds with no other fish
Fall fingerling	5–6"	50–150	Sept., Oct.	For initial stocking and restocking
Spring yearling	6–7"	50–150	May, June	For initial stocking and restocking
"Adult"	Over 7"	25–50	Spring or Fall	For initial stocking and restocking; can be expensive

Source: Schrouder, J. D., C. M. Smith, P. J. Rusz, R. J. White, and D. L. Garling. 1989. Managing Michigan ponds for sport fishing. Michigan State University Cooperative Extension Bulletin E-1554, East Lansing.

Spring stocking is generally recommended as opposed to other times of the year. The two most frequently stocked species in Vermont farm ponds are rainbow and brook trout. Because rainbow trout can tolerate slightly warmer water than brook trout, it may be the best one to stock in a pond that may approach the upper thermal limit for trout during the summer season. Brown trout may be offered for sale by some private hatcheries but are not recommended for stocking small ponds. They are generally more difficult to catch, therefore living to an older age and attaining sizes capable of feeding on smaller stocked trout.

Ponds that provide year round requirements for trout assuring good survival may only need to be stocked every other year or so. If your pond has characteristics that do not promote trout surviving through the summer (too warm water temperatures, insufficient dissolved oxygen), you may want to consider put-and-take stocking, i.e. purchase harvestable size (> 6 inch) trout in the spring of the year and fish them for consumption before midsummer losses occur. Under this type of management the pond will need to be restocked annually.

Because rainbow trout can tolerate slightly warmer water than brook trout, it may be the best one to stock in a pond that may approach the upper thermal limit for trout during the summer season.

If the pond supports fish, stocked or otherwise, fish-eating mammals and birds, such as otter, mink, mergansers, and herons may become regular visitors.

If your pond does not provide the environment needed by trout, the alternative is to stock it with warm water fishes. However, introducing bass or any other fish other than trout to your pond cannot be done legally without first obtaining approval of the Vermont Fish and Wildlife Department. Vermont law prohibits the stocking of any fish other than trout into waters including private ponds that have connections (water discharge) to waters of the state. A department fisheries biologist will determine whether the introduction of bass or other species poses a threat to fisheries occurring in public waters should they escape from your pond.

In more recent years releasing goldfish and koi (ornamental carp) into private ponds has become popular. However, these fishes are nonnative species in Vermont that have the potential of becoming aquatic nuisances. Should they escape your pond, they may become established in natural waters. Once acclimated to your pond or in the wild they are difficult and costly to control and can deteriorate water quality, such as by promoting turbid or muddy water and algae growth. Goldfish and koi are best left in an aquarium or in a completely self-contained garden pool. No aquarium fish should be released into the wild or in situations where they may have access to state waters.

WILDLIFE MANAGEMENT

A farm pond will invariably become habitat for a variety of other wildlife (frogs, newts, turtles, aquatic insects and other invertebrates, birds and mammals). This is natural and should be expected as ponds, unlike artificial swimming pools, can provide many of the habitat needs of wild animals including food, water, shelter, and breeding areas. If the pond supports fish, stocked or otherwise, fish-eating mammals and birds, such as otter, mink, mergansers, and herons may become regular visitors. Use by wildlife can be very rewarding for nature observation and education. Adopting the following practices will make your pond more suitable habitat for wildlife:

- Refrain from maintaining the entire shoreland in mowed lawn.
- Plant native shrubs, flowering plants and grasses along the shoreline to provide wildlife with food, shelter and nesting sites. Fruit-producing trees and shrubs are particularly attractive to wildlife.
- Retain some dead trees (snags) in the vicinity of the pond. These can serve as natural nest trees for certain cavity nesting birds.
- Place nesting boxes designed to attract tree swallows, wood ducks, and other cavity nesters.
- Leave a few downed dead trees, logs, and boulders in shallow water to serve as sun basking sites for turtles and refuge cover for fish.
- Be cautious with some emergent and submergent plants in shallow areas not used for swimming benefit fish and wildlife. Because cattails and water lilies can become invasive, they are not recommended in farm ponds.
- Construct or purchase a bat house to locate near your pond. Bats nightly consume tremendous quantities of flying insects.

Of course wildlife may include “unwanted” species that are incompatible with your primary uses of the pond. Examples are the otters or heron that makes daily forays to feed upon the trout you stocked, or the snapping turtle that takes up residence in a pond intended for swimming. Should these situations develop, effective solutions can be challenging. Nonlethal deterrents, such as electric fencing and predator scaring devices, are available; however, their effectiveness can vary

considerably. Lethal control (trapping or shooting) may be appropriate but is legally controlled and must have prior state, or in some cases federal, approval.

Occasionally farm ponds attract beaver, which can pose problems with regard to keeping pond discharge structures free of woody debris. Beaver also can cause destruction of nearby trees and shrubs and bring health concerns associated with the *Giardia* parasite which may be spread to humans and pets through the ingestion of infected water. Pond owners faced with nuisance beaver should consult the document *Best Management Practices for Resolving Human-Beaver Conflicts in Vermont* available on the Vermont Fish and Wildlife Department website (link provided in **Resources** below).

Beaver also can cause destruction of nearby trees and shrubs and bring health concerns.

PERMITS AND TECHNICAL ASSISTANCE

If you are contemplating building a new pond, renovating an existing one, or carrying out certain forms of management, note that in many cases state and even federal permits may be required. Permits are necessary to protect the public's safety; maintain environmental quality; and avoid negative impacts to certain fish, wildlife, plants, and unique natural communities. Frequently, a representative of the agency charged with issuance of the permit will arrange to visit the proposed pond site to determine whether a permit is needed and if so under what conditions the project can be permitted to move forward.

RESOURCES

U. S. Department of Agriculture, Natural Resource Conservation Service. *Farm Pond Ecosystems*. ftp://ftp-fc.sc.egov.usda.gov/WHMI/WEB/pdf/TechnicalLeaflets/FarmPond.pdf

Vermont Department of Environmental Conservation. "Aquatic Nuisance Control Permit." http://www.anr.state.vt.us/dec/permit_hb/sheet30.pdf

—. "Stream Alteration Permits." http://www.anr.state.vt.us/dec/permit_hb/sheet32.pdf

—. "Wetland Conditional Use Determinations." http://www.anr.state.vt.us/dec/permit_hb/sheet29.pdf

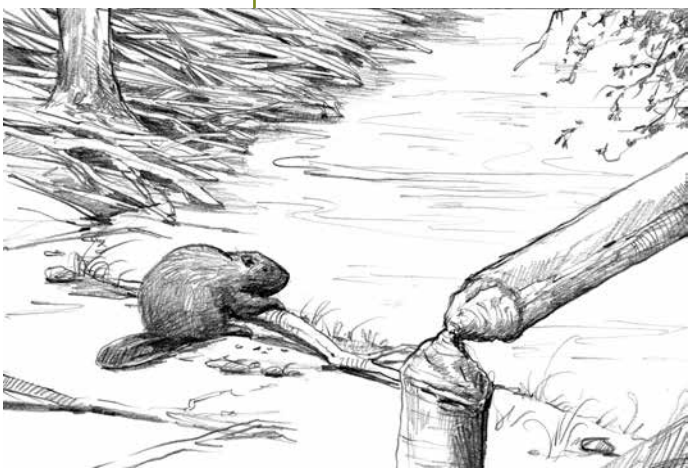
—. "What You Should Know about Constructing a Pond or Dam." http://www.anr.state.vt.us/dec/permit_hb/sheet32_1.pdf

Vermont Fish and Wildlife Department. "Managing Problem Beaver." http://www.vtfishandwildlife.com/library/reports_and_documents/Furbearer/Best_Management_Practices_for_Human-Beaver_Conflicts.pdf

—. "Pond Stocking Information." http://www.vtfishandwildlife.com/library.cfm?libbase_=Factsheets/fisheries/Pond_Stocking_Information

University of Vermont, School of Natural Resources. "Algae in Farm Ponds." http://pss.uvm.edu/vtcrops/articles/Algae.pdf

Bat Conservation International. Bat House Construction Design. www.batcon.org



14. RIPARIAN HABITAT MANAGEMENT

Riparian areas are ecosystems comprising streams, rivers, lakes, wetlands, banks, and floodplains that form a complex and interrelated hydrological system.

"Riparian" is defined as the land along the bank of a river or lake. Riparian areas are ecosystems comprising streams, rivers, lakes, wetlands, banks, and floodplains that form a complex and interrelated hydrological system. Because of the diverse and dynamic nature of riparian ecosystems, they support a wide variety of plant and animal communities, including insects, reptiles, amphibians, fish, waterfowl, songbirds, bats, mink, and otter. Many species are dependent upon healthy riparian ecosystems.

An intact riparian area functions as both a *buffer* and a *corridor*. By providing habitat and filtering runoff, a riparian area buffers the water body from the impacts of adjacent land uses. Riparian areas also act as a travel corridor to provide movement and dispersal routes for wildlife and plants on your land. When planning riparian conservation and restoration strategies, you should consider both the buffer and corridor functions of riparian areas.

BUFFERS

Riparian areas are important not only for the plants and animals that inhabit them, but also for the influence they have on adjacent waters. Forested areas between the water and developed land maintain habitat suitable for riparian species. The downed wood, leaves, and other organic material that riparian areas contribute to aquatic systems are important components of the food base and habitat structure in Vermont's water bodies. Fallen trees provide loafing areas for ducks, snakes, and turtles and important protective cover for fish. Mature trees and overhanging vegetation in riparian areas provide shade in the summer and insulate stream channels in the winter, moderating the effect of extreme temperatures. Coldwater species such as brook trout require water temperatures well below 70° F. While many of Vermont's larger streams regularly exceed 80° F during warm summer months, small tributary streams often provide cool water refuge for fish and other aquatic organisms inhabiting these systems. Wide forested buffers along riparian areas are also crucial for absorbing and filtering overland runoff, thereby protecting water quality. Roots of trees and other woody vegetation bind soils and help to maintain stable stream banks, preventing excessive stream bank erosion and sediment buildup in aquatic habitats.

CORRIDORS

Forested riparian areas serve as travel and dispersal corridors for wildlife. They are vital connections that enable wildlife to move safely from one habitat to another to feed, breed, and nest, and for young to disperse and set up new territories. Many species of amphibians and turtles rely on stream and river habitats during the breeding season and then spend most of their lives in upland habitat, often at a considerable distance away. Larger wildlife species also depend on these areas for travel. A Vermont Fish and Wildlife Department study shows use of riparian corridors to be important for black bear movement, particularly at road crossings (Hammond, 2002).

In addition to the ecological values of riparian areas, they serve other important functions for our everyday life. These ecosystems protect water quality for drinking and recreation, protect property from flood and ice flow damage, and provide for recreation, aesthetics, and educational opportunities.

RECOMMENDED FOREST BUFFER WIDTHS FOR WILDLIFE

Naturally vegetated riparian buffer widths of 100 feet from the top of the stream bank often provide for many of the functions necessary to protect aquatic habitats on stable streams and rivers. However, a vegetated riparian area of more than 500 feet may be required to provide suitable habitat for most bird species. Some riparian dependent bird species, such as bald eagle, great blue heron, and wood duck, may require buffers 600 feet or wider. Table 14.1 provides additional information on buffer width needs for various wildlife groups.

Table 14.1
Buffer width needs for wildlife

WILDLIFE GROUP	BUFFER WIDTH (in feet)
Most wildlife	660
Hawks	330
Riparian mammals	100 to 330
Reptiles and amphibians	100 to 330 (> 1000' for some species)
Songbirds	200 to 660
Nesting waterfowl	300 to 600
Bald eagle, nesting heron, cavity nesting ducks	600
Cold water fisheries	100 to 300

In general, the larger or wider the buffer is, the more likely it is to have value to wildlife. It is unlikely that most buffers that can practically be implemented will meet the needs of all riparian obligate wildlife and riparian associated rare species. Thus, due consideration to wildlife habitat in upland forest management is essential for protecting riparian species. Larger streams and those which naturally meander will generally require larger buffers than small, steep, and stable stream channels. A wider riparian area provides better protection of water quality and aquatic habitats, generally contains a greater diversity of habitats within, and creates greater distance between the aquatic resource and surrounding human development, ultimately protecting both ecological and property interests.

BUFFER MANAGEMENT

The best way to protect both aquatic and terrestrial wildlife habitat functions within the riparian area is to maintain as much of it as possible in an *undisturbed, naturally vegetated state.* A diversity of natural vegetation (trees, shrubs, and so on) is far superior to cropland, lawn, or other heavily managed areas for supporting wildlife. Where alteration of the riparian area is unavoidable, it should minimize impacts to buffer functions and connection to adjacent habitats. Natural features within the riparian area that may be of particular value to wildlife should be

A wider riparian area provides better protection of water quality and aquatic habitats, generally contains a greater diversity of habitats within, and creates greater distance between the aquatic resource and surrounding human development, ultimately protecting both ecological and property interests.

➤ PAGE 61

? Still don't find this in Drop Box. Please resend.

Figure 14.1
Woody debris in stream channels provides cover and shade.

identified and safeguarded (see Table 14.2). Other general rules of thumb for riparian buffer management include:

- Exclude livestock and vehicles from the buffer except for designed stream crossings. Cows and other livestock can trample plants, promote erosion, and degrade water quality.
- Control invasive plants to promote establishment of native trees and shrubs (see **Chapter 17, Invasive Species Management**).
- Do not dispose of refuse in the buffer. Dumping leaves, grass clippings, and other yard refuse can kill existing vegetation and result in stream bank erosion due to the loss of stabilizing roots. Remove urban debris such as tires and old appliances.
- Leave natural woody debris in stream channels to create pools and provide cover and shade for fish and other aquatic organisms (see Figure 14.1). Logging debris is not considered natural debris as it may be in violation of Vermont Acceptable Management Practices.
- Minimize the use of stream crossings. Where stream crossings are unavoidable, bridges are preferred over culverts as they present less of a potential barrier to fish and wildlife movements. Stream crossings often require state or federal permits. Contact a state river management engineer if you are planning to cross a stream with a culvert or bridge, or plan to conduct any activity involving a stream or river. (See link in **Resources** for more information on using pesticides near water.)

Timber harvest is regulated by the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont* which are intended to prevent discharges of sediment and petroleum products into surface waters. To further protect the broader functions provided by riparian areas, harvest of timber within or adjacent to riparian areas should be done with great care. Recommendations include the following:

Table 14.2
Natural features used by wildlife in a riparian area

NATURAL FEATURE	WILDLIFE SPECIES
Large dead standing trees	Hawks, osprey, and eagles use for nesting
Large cavity trees	Owls, wood ducks, hooded mergansers, and others use for nesting
Large dying trees	Bats roost under loose bark
Seasonal and vernal pools	Amphibians use for breeding
Understory tangles	Cover for many species
Large woody debris in streams	Turtles use for basking, fish for cover
Stream bank burrows	Weasels, otters, and muskrats make homes
Sandy soils with good sun exposure	Turtles use for nesting
Stone walls and rock piles	Snakes and small mammals use for cover/dens
Large overhanging trees	Flycatchers, kingfishers, osprey and other birds use as perches
Large stands of conifer trees	Deer use as wintering areas
Hollow trees and logs	Some mammals and birds use as dens
Fallen shaded logs	Some salamanders use as dens

- Locate logging trails and roads as far away from the waterway as possible to avoid erosion and any alteration to the stream flow.
- Maintain continuous and dense canopy along streams and ponds to maximize shading.
- Keep soil disturbance to a minimum and do not operate wheeled or tracked logging equipment when soils are wet. Consider harvesting during frozen conditions.
- Monitor for erosion before, during, and after harvesting. Look for cloudy water, algae growth, silt, or muck deposits on gravel streambeds, and new runoff channels or gullies. Suspend harvest or alter practices to minimize erosion of you see any of these signs.
- Try to spare nut- and fruit-producing trees for their wildlife value.
- In areas directly adjacent to the stream, leave dead or dying trees that may eventually enter the stream channel. In areas further from the stream, try to leave at least one to six snags or den trees per acre for those birds and mammals that rely upon them.
- Consider using vegetable-based, biodegradable oils and lubricants. These oils are non-toxic to fish. Keep fuel and maintain machinery well away from watercourses.

(For more information, consult "ANR Riparian Buffers and Corridors Technical Papers" at the link in **Resources**.)

Previously disturbed or degraded riparian areas may present opportunities for restoring wildlife habitat functions. For example, any work that removes pavement or lawn at the water's edge and replaces them with a vegetated buffer of native trees and shrubs is likely to benefit wildlife as well as fisheries and provide other functions of riparian areas (see Figure 14.2). Simply creating a no-mow zone along the water's edge will result in a naturally vegetated buffer over time.

If you desire quicker results or want to encourage certain plants through active revegetation, several experts — such as the Natural Resource Conservation Service, the Vermont Fish and Wildlife Department, local conservation commissions, and watershed associations — have expertise in this area and can provide guidance for effective riparian wildlife habitat restoration. These experts can help design the project, recommend beneficial plants, and direct you to sources for financial assistance for installing a riparian buffer. Their contact information can be found through the Vermont Fish and Wildlife Department website in **Resources.**

Figure 14.2
Riparian planting project along Barton River. *Courtesy of Paul Hamelin.*

RESOURCES

Hammond, F. M. 2002. "The Effects of Resort and Residential Development on Black Bears in Vermont." Final Report. Waterbury, VT: Vermont Fish and Wildlife Department, Agency of Natural Resources.

Vermont Agency of Natural Resources. "ANR Riparian Buffers and Corridors Technical Papers." http://www.watershedmanagement.vt.gov/rivers/docs/Educational%20Resources/rv_RiparianBuffers&CorridorsTechnicalPapers.pdf

Vermont Forest, Parks and Recreation. Vermont Acceptable Management Practices. http://www.vtfpr.org/watershed/ampprog.cfm

Vermont Fish and Wildlife Department. Contacts for Other Organizations. http://www.vtfishandwildlife.com/links.cfm

Department of Environmental Conservation. Water Crossing Permits. http://www.anr.state.vt.us/dec/waterq/permits/htm/pm_streamcrossing.htm

U. S. Department of Agriculture. Natural Resource Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

PART FIVE:
Grassland and Field Habitat Management

15. GRASSLAND HABITAT MANAGEMENT

Some of Vermont's most imperiled birds rely on the fields that many Vermonters manage as part of homes and farms. These birds, including the iconic bobolink and meadowlark, migrate north for the summer to breed in Vermont's fields. Due to a century of fields growing back into forests, increased development, and intensified agriculture, many of these species are declining across the continent. They depend on large, grass-dominated fields with other herbaceous plants, and few woody plants. In addition, fields should have a period of minimally disturbed time each summer for birds to breed and be located in open landscapes. By managing your land for grassland habitats through a variety of strategies, including the timing and location of mowing and grazing, you can maintain or enhance these features, and may reduce the challenge of supporting breeding birds in a working landscape.

By managing your land for grassland habitats through a variety of strategies, including the timing and location of mowing and grazing, you can maintain or enhance these features, and may reduce the challenge of supporting breeding birds in a working landscape.

VERMONT'S GRASSLANDS AND GRASSLAND BIRDS

Before European settlement, New England was mostly forested, and grasslands dotted the landscape in small areas of floodplains, beaver meadows, sandplains, barrens, and Native American settlements. From the 1600s through the late 1800s, as much of the land was cleared, grasslands came to dominate the northeast. In Vermont, populations of grassland birds likely reached their peak in the late 1800s, when a large part of the state was managed as open land for grazing sheep. However, the total area of grasslands useable by nesting birds declined greatly in the last century in Vermont and in the northeast. Fields became overgrown with woody vegetation, were converted to row crops such as corn, or were lost entirely as a result of development.

Other grasslands have declined in quality due to more frequent cutting of hay, more intense grazing, or fragmentation from development. These changes have caused the direct loss and decreased quality of grassland habitat.

Currently, most of Vermont's grassland habitats are associated with agriculture in the Champlain Valley and, to a lesser extent, the Connecticut River Valley and the area around Lake Memphremagog. Grassland habitats in Vermont vary in their size, shape, and plant species. They can be wet or dry depending on soil type and topography. Vegetation is typically dominated by nonnative cool season forage grasses and forbs but may also include native cool season grasses and forbs (herbaceous platns). Fields that are cut for hay are often dominated by grasses, while fields that are cut less frequently tend to have a high percentage of forbs.

Figure 15.1
Bobolinks thrive in unmown pastures.

Many bird species rely on Vermont's grasslands. Returning each spring from wintering grounds in the southern U.S. and Central and South America, these birds establish territories, build nests, breed, and raise their young — all in grasslands. Some of the better-known grassland birds include bobolink, meadowlark, killdeer, savannah sparrow, northern harrier, and American kestrel. Many of these species are experiencing range-wide population declines and are considered species of greatest conservation need in Vermont's Wildlife Action Plan. In addition, some of the less well-

➤ PAGE 65

Even smaller patches of grassland habitat may provide suitable nesting conditions for grassland birds if situated within a landscape of other large, high quality grassland habitats.

known grassland birds are facing even more grave threats: Three species, Henslow's sparrow, upland sandpiper, and sedge wren, are listed as endangered in Vermont. The grasshopper sparrow is listed as threatened. Overall, grassland birds are some of the fastest declining species across the northeast.

In addition to the grassland specialist birds, many other birds take advantage of grasslands for part of their habitat requirements, including short-eared owl, blue-winged teal, and eastern bluebird. This guide, however, focuses on management for grassland specialists including upland sandpiper, bobolink, eastern meadowlark, and grassland sparrows. Other species will benefit too, but may also require some other conditions such as proximity to wetlands and presence of cavity trees or nest boxes for nesting. See **Chapters 6** and **7** on songbirds and early successional habitat for more information.

HABITAT REQUIREMENTS

The habitat requirements for grassland birds vary from species to species, but in general, include large, grass-dominated communities, with other herbaceous plants, few woody plants, and occur in generally open landscapes, often dominated by agriculture. More specifically, these habitats are characterized by:

- ***Size (large and wide):*** Grasslands larger than 25 acres will be most productive for birds. Grasslands as small as 10 acres, however, will support some birds (especially in open landscapes, as described below). In addition, grassland birds avoid edges with forests and development, so circular or square fields provide more prime interior habitat than long, narrow fields with a greater degree of edge.
- ***Vegetation Condition (Grass-dominated):*** Grassland birds prefer a habitat with 50 to 75 percent grass cover and the remainder as forbs. Grasslands composed primarily of grasses will support more birds than those dominated by goldenrods, thistle, and other forbs or row crops such as corn (row crops are not considered quality habitat for grassland birds). In addition, the absence of woody plants such as shrubs (e.g., dogwood, alder, cherry) create better quality habitat for grassland birds (see Figure 15.2). These species require the open character provided by the low, dense nature of grasses and forbs.
- ***Landscape:*** Grasslands surrounded by other open fields, or located within a region where other large, open grasslands occur will support more birds than those surrounded by forests or development. Even smaller patches of grassland habitat may provide suitable nesting conditions for grassland birds if situated within a landscape of other large, high quality grassland habitats. Generally speaking the Champlain Valley and parts of the Lake Memphromagog watershed provide important focus areas for grassland habitats and the birds that require them.
- ***Limited Disturbance:*** Grassland birds also need a period of time when they can breed with risk of disturbance from agricultural equipment and farm practices. Birds typically arrive in early May, and initiate breeding almost immediately. After 49 to 52 days, young birds should be developed enough to escape mowing equipment, livestock, predators, or other disturbances. Because some birds will breed multiple times in one year, and others will start new nests after failed attempts, a field will be continuously used for breeding until about early to mid-August. Since much of the suitable grassland habitat

in Vermont is supported by working farms, this is perhaps the most important consideration when managing for the benefit of birds like bobolink, meadow lark, and vesper sparrow.

MANAGEMENT RECOMMENDATIONS

Managing grasslands for bird habitat involves three basic steps. These include:

- ***Maintain or restore large grasslands.*** Size of grassland habitats is a critical component to the quality of the area for grassland birds. Bobolink and other grassland dependant birds typically require grasslands of at least 50 acres, although they will utilize smaller patches of habitat if they are of high quality, free of disturbance during the critical nesting period, and are within a larger framework of other larger patches of grassland habitat. Therefore, an important consideration is to identify and maintain those large patches of good quality grassland habitat.
- ***Manage fields for grasses.*** Mowing fields annually, or semi-annually, will maintain dominant grasses, preventing the establishment of shrubs and colonizing saplings. In addition, removing grass cuttings after moving will provide the best conditions for grasses to regrow the following season. In large areas, rotational mowing and/or burning can provide a mosaic of grassland types, attracting a greater diversity and abundance of grassland birds.
- ***Avoid or minimize nest loss from mowing.*** The timing of management activities is perhaps the most crucial factor for the successful breeding of grassland birds. Management of fields that are not used to grow hay for livestock forage should be mowed after August 15 to allow for successful breeding of grassland birds. If this is not feasible, delaying mowing until mid-July allows most birds to successfully raise young to the point of being fledged and able to fly and avoid mowing equipment.

Where forage is desired, managers should consider late-cut refuges and delayed second cuts. Late-cut refuges are certain areas of fields left uncut until August, to allow some successful breeding on the property. These refuges may be chosen for their wet or poor soils, to minimize any lost forage production, but should be centrally located in the field away from edges. Delayed second cuts allow a window for birds to breed throughout the property in early summer. Early/first cuts are made before June 1, then the second cut is delayed 65 days after the first, to allow time for the grass to regrow (14 days), the birds to nest (42 days), and young to develop flight (9 days). On productive sites, a third cut may still be possible.

Figure 15.2
An ideal grassland for birds includes large, wide-open landscapes with few woody stems.

Bobolink and other grassland dependant birds typically require grasslands of at least 50 acres, although they will utilize smaller patches of habitat if they are of high quality, free of disturbance during the critical nesting period, and are within a larger framework of other larger patches of grassland habitat.

Although not a replacement for delayed mowing, other mowing strategies can help reduce the loss of birds and nests, as well as impacts to other wildlife such as newborn deer fawns and wild turkey poults, including: avoid mowing areas where birds are frequently seen, and instead mow field edges first (edges of fields are not the highest quality habitat), raise mower blades to 6 inches or more, avoid mowing at night while birds and other wildlife sleep, and use flushing bars on haying equipment to encourage birds and other wildlife to escape mowing equipment.

Where grazing is a primary management strategy, fallow paddocks may be left to allow birds to breed undisturbed. Because grazing animals may trample or cause birds to abandon nests, more concentrated and frequent grazing will prevent birds from breeding. Like late-cut refuges discussed above, leaving certain areas free from grazing for at least 50 days will allow birds to breed successfully.

By following these guidelines, you can maintain and enhance crucial grassland bird habitats. Landowner incentives may also be available for some practices. Contact the Natural Resources Conservation Service for more information about the programs available to landowners who wish to manage wildlife habitat. (See **Resources** for links.)

RESOURCES

U.S. Department of Agriculture, Natural Resources Conservation Service. *Management Considerations for Grassland Birds in Northeastern Haylands and Pasturelands*. http://www.nrcs.usda.gov/wps/portal/nrcs/main/vt/technical/ecoscience/bio/

Vermont Fish and Wildlife Department. "Vermont's Wildlife Action Plan." http://www.vtfishandwildlife.com/SWG_home.cfm

16. OLD FIELD MANAGEMENT

"Old field" is a broad term that applies to many open habitats transitioning from field to forest. They are dominated by forbs, grass, shrubs or small trees based on the length of time since abandonment and management history. Similar to grasslands, the benefits of this habitat to wildlife depend on the size, configuration, vegetation height, percent woody vegetation cover, as well as density and composition of the area.

Old field habitats in Vermont are important for shrubland birds, which use a variety of habitats, including old fields, shrublands, and young forest. Old fields are also used by other wildlife such as butterflies and bees, cottontail rabbits, deer, snipe, turkeys, bobcats, green and rat snakes, frogs, and many others. Shrubland birds are the focus of many management plans because 22 of 40 birds associated with shrubland habitats are currently undergoing significant population declines in eastern North America. Additionally, 139 species of reptiles, amphibians, birds, and mammals either prefer shrub and old-field habitats. Shrubland bird species in Vermont include common yellowthroat, white-throated sparrow, field sparrow, Eastern towhee, American woodcock, brown thrasher, and more rare species such as prairie warbler, golden-winged warbler, and vesper sparrow.

Shrubland birds are the focus of many management plans because 22 of 40 birds associated with shrubland habitats are currently undergoing significant population declines in eastern North America.

Figure 16.1 Although larger areas of old fields provid better quality habitat for wildlife, even old fields less than five acres in size can be important to a variety of wildlife.

➤ PAGE 69

Management for old field habitat is largely focused on maintaining areas that already exist, rather than creating new non-forested habitat.

While small areas of old field less than five acres in size can be important to a variety of wildlife, as a land manager, you should prioritize the management of large blocks or within large blocks of similar habitat. Some shrubland birds are "area sensitive" which means they prefer and select large areas of contiguous habitat for breeding. Birds such as the brown thrasher will use smaller fields but the more uncommon species such as vesper sparrows or golden-winged warblers require areas of 25 acres or more.

AREA SELECTION

As the term implies, old fields are habitats that exist were previously used for agricultural activities on the landscape. Therefore, management for old field habitat is largely focused on maintaining areas that already exist, rather than creating new non-forested habitat. These areas are best maintained by removing larger trees and periodically mowing or brush hogging.

Focus your attention on areas that are still primarily open and that are more than five acres in size. Large, wide areas of old field habitat are favored because they have a more interior nesting habitat relative to the amount of edge where predators often search for food. Long, narrow fields have less interior nesting habitat relative to the amount of edge.

The actual field size for shrubland birds becomes less important when the field is within a landscape of similar habitat, so it is important to consider the landscape when determining your management plan. Managing old fields, pasture, or hayfields with hedgerows, scrub-shrub wetlands, young forest, power line rights-of-way, or similar habitats is a great way to maintain or improve conditions for shrubland birds.

MANAGEMENT TECHNIQUES AND GUIDELINES

Wildlife that use old field habitat tend to rely on the short, woody vegetation for cover and for hunting prey. Maintain a minimum range of 10 percent shrub and young tree crown cover. Lower percent woody cover in the field may limit abundances of some species and favor others. Allow some areas to become shrubby by brush hogging around them or by maintaining the field in its current condition and incorporating even-aged forest management on adjoining lands. You should also maintain herbaceous habitat including bare ground, grasses and forbs. These are productive areas that provide food such as insects, nectar, and fruits, as well as courtship areas that are critical to many species. They also serve other important habitat functions.

Proper management of old field habitat increases plant species diversity, structure (the different heights of vegetation) and patchiness (arrangement of vegetation) in order to provide a mosaic of different vegetation conditions. Brush hogging should not take place on the entire field at once; the field should be broken up into sections that will be mowed on a rotation. This is particularly important for late nesting birds, migrating birds, small mammals, and pollinators that may be active late in the summer.

Recent research indicates that old fields and wildlife openings should be managed on much longer rotations than managers have historically used. Many species will use low woody vegetation for cover but many others need taller wood vegetation in these successional areas. Maintaining these types of old field habitats on a 10-year rotation with a brush hog can be difficult. A good alternative would be to mow the

field in a mosaic where certain areas will be disturbed on long rotations (10+ years) and others on 1- to 2-year rotations. This will create a diverse habitat with patches of woody vegetation dominated by shrubs of different heights interspersed with grass/forb areas with a few taller trees about the field. By selecting, designating and retaining patches of valuable wildlife shrubs across the field and limiting taller trees, you can prolong the successional process as shrubs will not grow very tall and shade out the habitat below. This approach will provide valuable habitat for a long period of time.

Scattered tall trees can serve as mast sources and perches. But too many tall trees can come to shade the management area reducing the amount of low cover. Tall trees can be cut, girdled, or treated with herbicide. Cut trees can be used to construct brush piles. Girdled trees will become snags that provide perches for hawks, roosting sites for bats, and cavity sites for nesting birds.

Mowing or brush hogging must occur outside the primary nesting season which is April 15 to August 1. Tree cutting should also take place outside the primary nesting season. Minimum mower deck height should be 6 inches. Where wood turtles, rat snakes or other reptiles of concern are known to occur, mow after October 1. Mow or brush-hog in old fields every 2 to 5 years depending on site conditions and prescriptions for different parts of the field. Leave shrubs that are valuable for wildlife such as serviceberry, elderberry, alder, viburnums, willows, dogwoods, and hazelnut.

MAINTENANCE

Benefits of old field habitat decline over time as trees mature and out-compete grasses, forbs, and shrubs. Be sure to monitor old fields and remove trees as they detract from the old field habitat (generally by excessive shading from groups of trees). In some cases, shrubby areas may need to be set back to re-invigorate the patch. Winter cutting is recommended to maximize re-sprouting. Also, monitoring is critical for invasive plant species that tend to thrive in old fields such as bed straw, honeysuckle, multiflora rose and buckthorn.

RESOURCES

U.S. Department of Agriculture, Natural Resources Conservation Service. "Conservation Practices Benefit Shrubland Birds in New England." 2012. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046969.pdf

—. "Early Successional Habitat Mgt. Job Sheet (647) – Old Field Management." http://efotg.sc.egov.usda.gov/references/public/VT/JS647VT_OldField_FillableForm.pdf.

—. "Ecology and Management of Scrub-shrub Birds in New England: A Comprehensive Review." 2007. ftp://ftp-fc.sc.egov.usda.gov/NHQ/nri/ceap/schlossbergkingreport.pdf

—. "Shrubland Bird Info Sheet." 2012. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081112.pdf

—. "What is Early Successional Habitat?" 2009. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081109.pdf

By selecting, designating and retaining patches of valuable wildlife shrubs across the field and limiting taller trees, you can prolong the successional process as shrubs will not grow very tall and shade out the habitat below.

PART SIX:
Invasive Species Management

17. CORRECTIVE STRATEGIES FOR INVASIVE SPECIES

Often hardy and sometimes toxic, invasive species have become widespread on roads and ditches, deep in the forest and throughout meadows, on wetland edges, under water and in the air. An *invasive species* is "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health." Most alien species (also referred to as exotic or nonnative) are not a threat to Vermont's ecosystems. However, exotic species become invasive and a nuisance when they develop self-sustaining populations and out-compete native species, potentially impacting timber quality, soil chemistry and structure, wetland dynamics, and native species diversity.

Whether accidental or intentional, the introduction of invasive species must be avoided and current populations must be managed.

ORIGINS AND CHARACTERISTICS

Plants

Plants have been moved around the globe for centuries, carried across oceans for food, shelter, medicine, and ornament. Today, the sale, importation, and propagation of exotic plants is heavily regulated by various state and federal laws. In Vermont, the Plant Quarantine Rule was passed by the Vermont Legislature in 2002, making it illegal to "sell, distribute, or transport" specific exotic species. Lists were subsequently created that aid gardeners and landscapers with finding substitutes for quarantined species.

Despite regulations, exotic invasive species continue to alter Vermont's landscape. Established invasive populations of plants spread through natural dispersal mechanisms. People are also responsible for their inadvertent spread by seeds and fragments attaching to shoes, clothing, equipment, and boats, which are then dispersed to unaffected areas. Whether accidental or intentional, the introduction of invasive species must be avoided and current populations must be managed.

Figure 17.1
Image of common buckthorn.
Courtesy of L. Mehrhoff.

Exotic invasive plants succeed in new ecosystems for a number of reasons. For instance, each multiflora rose plant can produce 500,000 fruits and the plant forms dense thickets, thus out-competing native species. Common buckthorn is highly adaptable and also forms dense thickets (see Figure 17.1). Exotic species are typically less susceptible to local pests and diseases, and some such as garlic mustard produce toxins that deter native plants from growing. Invasive species tend to thrive in areas that have been or continue to be heavily disturbed.

Wildlife

Species of nonnative wildlife have been introduced through the ballast of cargo ships; these ships are now under the oversight of the U. S. Coast Guard to minimize the introduction of invasive species. Some nonnative insects have also succeeded in becoming pests. The hemlock woolly adelgid is a species that has causes widespread mortality of hemlock by sucking sap (see Figure 17.2). The Asian longhorn beetle and Eastern ash borer are also invasive pests that are causing devastating effects on forest health in the Northeast. Invasive pests and the effects they have on forest

Figure 17.2
Wooly adelgid on hemlock. Courtesy of Robert L. Anderson, U.S. Forest Service, Bugwood.org.

health are important for you to consider when developing management plans for your property. For up to date information on infestations and new species accounts, visit the Vermont Invasives website at www.vtinvasives.org.

Illegal importation, bait bucket dumping, release of aquarium species, and escapees from private facilities are the likely causes of invasive species into Vermont's lakes and ponds. Goldfish, tench, rudd, and alewife are all baitfish species that Vermont anglers and fisheries managers are currently battling.

Recognized by the International Union for the Conservation of Nature as an invasive species, outdoor, feral, or stray cats are also one of the most controversial. As domesticated descendants of a Middle Eastern wild cat, the house cat is the most common pet in the United States. Unfortunately, the impact on native wildlife can be tremendous when these hunters stray from home or become feral. If you own a cat be mindful of this phenomenon and keep them indoors or have them wear a collar with a bell to warn birds and other wildlife of their presence.

Impacts

Invasive species can negatively affect native ecosystems in myriad ways. Forest regeneration is reduced as a result of intense shading and competition for space with exotic species. Soil chemistry is altered by chemicals produced by some exotic plants and European earthworm activity. Native species decline or may even disappear from a site. Since native insects and animals often find exotic species unpalatable, food chains are disrupted and habitat is degraded. These are just a few examples of the ecological changes resulting from invasive species. Table 17.1 highlights several common invasive species and their known impacts.

The ecological impacts of exotic invasive species on Vermont are vast, but the economy, human health, and recreation are also affected. The zebra mussel is an invasive species in the Lake Champlain region detested for its prolific colonies that clog intake pipes, potentially damage underwater cultural resources, and out-compete native mollusks. Additionally, invasive aquatic species that reproduce rapidly can soon outnumber native species and dominate their habitat. The result is often reduced numbers of native species, reduced habitat and water quality, and a diminished experience for anglers and paddlers alike.

It can be especially disconcerting when an exotic invasive species poses a threat to human health. Giant hogweed, wild parsnip, and wild chervil all contain a phototoxic sap (see Figure 17.3a and b). If exposed to sunlight after touching this sap, a reaction occurs that causes

Figures 17.3 a and b
Giant hogweed (left) and wild chervil (right)

Table 17.1
Selected invasive species and their associated ecological impacts

SPECIES	ECOLOGICAL IMPACT(S)
Hemlock Wooly Adelgid	Loss of hemlock stands could severely impact quality and quantity of deer wintering habitat and potentially affect the health of the State's deer population. Lack of shade along streams could impact fish habitat.
Invasive Fishes (Asian carp, alewife, tench, etc)	These species out-compete native sport fish for food and habitat. Some species will prey on the eggs and fry of native species such as smelt and walleye.
Aquatic Invasive Plants (water chestnut, Eurasia milfoil, and so on)	Thick stands of aquatic invasive plants impede water-based recreation such as boating, fishing, and swimming.
Japanese Knotweed	Frequently found along rivers and streams, this plant's early spring emergence and dense growth prevent native species from establishing in these traditionally species diverse areas. Less food and habitat is provided in knotweed monocultures.
Garlic Mustard	Notorious for quickly dominating groundcover plants and excluding native species through dispersion and chemical disruption of native root associations, thus altering suitable habitat for native birds, mammals and amphibians.
Purple Loosestrife	Although a beautiful plant, it quickly replaces native wetland species such as cattails and sedges, and holds little value as a food or habitat source for wildlife.
Common and Glossy Buckthorn	Both species produce fruits that are eaten and distributed by wildlife, thus enabling the creation of dense, even-aged thicket stands that crowd and shade out native species and impact success of native nesting birds.

burns, blistering, and skin discoloration. Gloves and long sleeves are recommended when working with these and any of the knapweed species. In addition, outdoor cats spread parasites through feces and are common carriers of the rabies virus.

MANAGEMENT

The myriad impacts resulting from exotic invasive species can be overwhelming and discouraging. However, with careful management and the right attitude, you will have some success at prevention and control of them on your land. Even if full eradication is not achieved, habitat for wildlife can be improved and native species will benefit.

The first step in successful control is to positively identify exotic invasive species on your property. There are many resources for identification online or in publication. If you are unable to identify invasive plants or animals using the resources listed in the suggested readings section below, seek the help of a professional botanist or other natural resources professional.

There are three categories for managing invasive species: chemical, mechanical, and biological.

Once invasive species have been identified on your property, a plan of attack is needed. Visual documentation through pictures can be used to measure management success over time. Some landowners may opt to hire a professional consultant to write a plan and create a map, while others will conduct their own research and use a hand-drawn map. Regardless, mapping the location of invasive populations on your land can be helpful in future monitoring efforts as well as for measuring success.

The Vermont Invasives collaboration has included a feature on their website which enables landowners to map invasive plants or animals on their property. This feature can be very useful in your own land management efforts. It is a good idea to approach the management of invasive populations on your land while considering other features within an area. Some infestations may vary by site, and Table 17.2 below can help narrow down an appropriate management approach.

If your land is enrolled in the Use Value Appraisal (UVA) Program and a management plan has been developed, speak with your county forester about recommendations for maintaining forest health through the prevention and control of invasive species. Integrating invasive species management into any forest or wildlife management plan is an important

Table 17.2
Strategies for managing invasive species based on infestation level

SITE CHARACTERISTICS	MANAGEMENT APPROACH
Pristine: less than 10% cover of invasives	Prevention is key. Eradicate all populations of invasive species. Monitor "cleaned" sites and adjacent areas to remove new plants. Look for new species known to be in the area.
Somewhat disturbed: 10-30% cover of invasives (monocultures not yet formed)	Prioritize management activities based on the following: 1. Level of threat invasives pose to the site. 2. Special natural features (vernal pools, sugarbush, etc), wildlife habitat, or native species that warrant special effort 3. Practical and economic feasibility of species-specific treatment options Treat small infestations from the edge into the center and focus on controlling seed-bearing individuals first. Total eradication may not be possible.
Heavily infested: greater than 30% coverage of invasives	Don't get discouraged! Focus on protecting remnant patches of native vegetation and special natural features from invasives. Prioritize management based on the 10 to 30% cover scenario. Revegetation with native species will likely be necessary.

Source: Cusack, C., Plumb S, and D. Prince. 2011. Best Management Practices for the Prevention and Treatment of Terrestrial Invasive Plants in Vermont Woodlands. Montpelier: Vermont Chapter of the Nature Conservancy.

step to avoid their inadvertent spread. Whether or not a management plan is in place, early detection and rapid response is essential to stopping the spread of invasive species onto your property. There are three categories for managing invasive species: chemical, mechanical, and biological. Some methods are better for certain species and levels of infestation than others, and an understanding of these techniques and applications will help determine what is most suitable for your site.

Chemical

For invasive plants, chemical management involves the use of herbicides. In the State of Vermont you may apply a non-restricted use herbicide to your own land, but certification is required through the Vermont Agency of Agriculture for application of herbicides on land other than your own or to apply restricted use herbicides. Use of herbicides needs to be in accordance with the label. ***The label is the law!*** You could also hire a professional contractor who specializes in invasive species control.

Two types of herbicides are most commonly used in invasive species management — glyphosate and triclopry. *Glyphosate* is a non-selective herbicide that can kill any plant it comes in contact with by interrupting its photosynthetic process. Aquatic, restricted use formulations exist for use near wetlands, but a permit from the Department of Environmental Conservation is required and these herbicides can only be purchased and applied by a certified pesticide applicator. *Triclopyr* is more selective and is used on plants that are more difficult to control without impacting monocots (grasses, orchids, lilies, and so on). Most formulations of this herbicide require a license to purchase and use. When dealing with chemicals, employing the correct formulation and concentration at the right time of year for your target species is critical. Consideration should also be given to the impacts of chemicals on nontarget species.

Small-scale problems typically require a *foliar* application, or spraying leaved and flowering plants with the herbicide. This can be done with a backpack sprayer or even a handheld spray bottle with a low concentration of active ingredient, conducted on a day when there is no wind and no threat of rain for the next 3 to 48 hours (depending on chemical). Some plants respond to treatment best if the existing stems are completely cut in spring and re-growth is sprayed in early fall. Remember that every species has different application rates and times to spray, and that using the least amount to work effectively on the target species will save money and minimize impacts to nontarget species.

Cut stem treatments involve cutting the stem close to the ground and immediately applying herbicide to the stump. These treatments are most effective in the fall and only the living tissue on the outer layer of the stem needs to be treated. Mixing a dye with the herbicide solution will stain treated surfaces and prevent reapplication and overuse of herbicide. Care should be taken with this method not to exceed per label allowed rates.

Mechanical

Mechanical control can be very intensive and involve several years of management, but it can also be effective. Many techniques are utilized on various species of invasive plants, and finding the right method based on plant biology is the most effective approach to eradication.

Figures 17.4
Foliar spray approach.
Courtesy of Steve Manning, Invasive Plant Control, Bugwood.org

Figures 17.5
Regular mowing to control invasive species. Courtesy of VFWD.

Girdling refers to the use of a chainsaw or axe to make two to three circular cuts set at three inches apart around the circumference of trees or shrubs with a single stem.

Hand pulling limits the eradication effort to only the target species. It is most easily accomplished when the ground is moist and soft such as in the spring or after a rain. If working in those conditions isn't possible, a shovel or weeder may help remove the plant stem. With or without tools, remove the entire plant, including the root and rhizomes to avoid re-sprouting. Avoid hand pulling when berries are ripe or seeds are set to minimize accidental spreading. Pulling causes site disturbance, and you should make an effort to put disturbed soil back in place to minimize re-colonization.

Cutting or mowing is best used where invasive plants exist in large monocultures or have extensive root systems (such as with Japanese knotweed), and at sites that can be visited often. This method works by continually stressing the root system and depleting carbohydrate reserves in the plant through multiple cuttings over a period of time. It may take several years to accomplish this and a commitment should be made to continue this method as long as it takes to eradicate the problem species.

Smothering a site with UV-stabilized plastic will effectively kill most plants underneath. It is helpful to remove all above-ground vegetation prior to covering, and extending the cover 3 to 5 feet from the affected area as a "buffer zone." Secure the plastic with rocks or stakes and leave in place for a full growing season. For species such as knotweed, goutweed, and wild chervil, leaving the plastic in place 2 to 4 years proves more effective.

Girdling refers to the use of a chainsaw or axe to make two to three circular cuts set at three inches apart around the circumference of trees or shrubs with a single stem. The living tissue of the cambium layer (inner bark) will no longer be able to transport essential nutrients and sugars and will eventually kill the plant. The cut should not be too deep to avoid creating a hazard under high wind situations. Re-sprouts can be a problem with this approach.

Biological

Biological management usually involves the introduction of an invasive species' natural predator to the ecosystem. In Vermont, two species of leaf-eating beetles and a root-boring weevil have been released, each feeding on purple loosestrife in their native Europe. Sites where beetles have been released have seen reduced growth rates of loosestrife and signs of native plant recovery. This method is overseen by Vermont's Department of Environmental Conservation and is unavailable for private landowners without permission.

SUMMARY

Having so many options available for exotic invasive species control and management may be confusing, but ample resources for information and education are available. For instance, specific species information can be found at www.vtinvasives.org. In addition, the suggested links that follow in **Resources** are a good place to start in your effort to manage your land. As you move forward with management, replanting will be a likely step in reclaiming your land. Planting native species at a site or stocking native fish in a pond is always recommended over the alternative, which can lead to ongoing problems for Vermont's economy, ecology, health, and recreation. Be sure to check with the Vermont Department of Forests, Parks, and Recreation for sources to obtain native stock of plants and for any quarantines that may be in effect that apply to the transportation of woody plants in Vermont.

RESOURCES

Cusack, C., Plumb S, and D. Prince. 2011. *Best Management Practices for the Prevention and Treatment of Terrestrial Invasive Plants in Vermont Woodlands.* Montpelier: Vermont Chapter of the Nature Conservancy.

Lake Champlain Basin Program. "Aquatic Nuisance Species in Lake Champlain and the Basin."http://www.lcbp.org/nuissum.htm

National Invasive Species Information Center. http://www.invasivespeciesinfo.gov/index.shtml

U.S. Department of Agriculture, Natural Resources Conservation Service. Invasive Exotic Plant Info Sheet. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081111.pdf

Vermont Department of Agriculture. Pesticide regulations. http://www.vermontagriculture.com/ARMES/pest.htm

Vermont Invasives. http://www.vtinvasives.org/

—. Management Tools. http://www.vtinvasives.org/plants/prevention-and-management/tools-resources

—. Vermont Invasive Exotic Plant Committee. http://www.vtinvasives.org/plants/vermont-invasive-exotic-plant-committee

—. Invasive Plant Impacts. http://www.vtinvasives.org/plants/impact-invasives

—. Quarantine Rule. http://www.vtinvasives.org/plants/state-quarantine-rule

—. Watch List: http://www.vtinvasives.org/plants/report-it

—. Vermont Invasive News Updates: http://www.vtinvasives.org/news

PART SEVEN:
Habitat Management for Game Species

18. WHITE-TAILED DEER

Odocoileus virginianus

SUMMARY

White-tailed deer are one of the most popular game species in Vermont. They occupy a wide variety of habitats, from lowland farm fields to upland forests. Protecting wintering habitat is crucial for deer. Deer survive the winter by seeking the shelter of large areas of multi-aged softwood forests to protect them from deep snow and cold temperatures. When humans or dogs move into their wintering areas, deer are forced to expend valuable winter energy. Feeding deer in winter is illegal in Vermont and frequently kills the animal because deer have evolved to eat course woody browse in winter. In other seasons, deer feed on shoots and leaves, agricultural crops, and mast crops such as beech nuts, acorns, apples, and other fruits.

Maintaining the functional cover and safety properties of deer yards is important for long-term sustainability of Vermont's deer herd.

NATURAL HISTORY

The white-tailed deer is one of five members of the deer family (*Cervidae*) found in North America, the others include mule deer, elk, caribou, and moose. The white-tailed deer is widely distributed with more than 30 described subspecies found from Venezuela to southern Canada. The subspecies found in Vermont is known as the Northern white-tailed deer (*Odocoileus virginianus borealis*).

Generally speaking, white-tails are very adaptable and occupy a wide variety of habitat types. The deer of Vermont thrive as a forest edge species. Habitats which feature a mosaic of large woodlots and agricultural openings provide ideal living conditions for deer. Because they are so adaptable, deer are found in the forest land of the Green Mountains, the Northeast Highlands, the farmlands of the Champlain Valley, and the Connecticut River valley.

Figure 18.1
Deer habitat components consist of large woodlots and agricultural openings.

Deer are ruminant herbivores meaning that they are plant eaters with a four-chambered stomach like a cow. Deer are more selective than cows and require more easily digested plant matter. The chambered stomach allows deer to eat a large variety of woody and succulent plant types. Deer are also known to occasionally eat protein-rich items like bone, dead fish, and bird eggs.

More than 600 different foods have been identified as deer food. Forbs (herbaceous plants), leaves, twigs, and agricultural crops like alfalfa and oats make up the bulk of the deer's spring and summer diet. Deer build reserves of body fat to survive the winter months by replacing some of the green forage in their diet with foods high in fat and protein in the fall, such as acorns, nuts, mushrooms, apples, and other fruits.

➤ PAGE 81

During the critical wintering period when snows are deep, potentially from December 1 through April 15, it is essential that deer stay in wintering areas; forested areas containing stands of mature softwood trees with large contiguous crowns.

During the winter (which can last up to five months in Vermont), food is either scarce or difficult to obtain because of deep snow. Until snow conditions become too restrictive, deer will also paw the ground in search of the forbs, nuts, and apples remaining from the previous autumn.

Deer mostly rely on fat accumulated in late summer and early autumn to survive winter. They also grow a winter coat to minimize heat exchange with the environment. Deer conserve energy during winter by seeking shelter from cold winds and deep snow in softwood forests. Deer also restrict their daily movements to those absolutely necessary and reduce their feeding in winter, entering a state of semi-hibernation. When they do eat, their food is primarily the buds of small trees and woody shrubs and the needles of evergreen trees such as cedar and hemlock, and fir to a lesser extent. These winter foods, referred to as 'browse,' are high in fiber and low in energy and do not fully meet a deer's daily winter energy demands. Wind-storms often bring nutritious tree litter and lichens down to within the reach of deer. However, deer are very dependent on their fat reserves to survive the winter. Even captive deer fed an unlimited nutritious diet reduce their forage intake and lose weight during severe winter weather. This is a natural adaptation allowing a large herbivore to survive the long annual dormant period for vegetative growth. When spring approaches, deer's metabolism increases and they must find emergent vegetation to meet this increased energy demand.

Deer mate in the fall (early November to mid-December in Vermont). Gestation is just beyond 200 days with fawns born from mid-May to early July. Doe fawns can occasionally conceive offspring under optimal habitat conditions but breed and give birth later than mature does. Reproductive potential is highest at 2 years of age, and does frequently produce twins or even triplets when deer densities are not too high. Bucks in good habitat become sexually mature as yearlings, and they begin to challenge older bucks for breeding rights. About half of yearling bucks produce more than two antler points in Vermont. In Vermont, does can live 15 years, but bucks usually do not survive more than 5 years.

A healthy deer herd has tremendous reproductive potential. When determining the annual harvestable surplus, deer managers subtract adult mortalities from the rate of fawn survivorship to 1-year-old (called recruitment). Starting in 1979, the Vermont Fish and Wildlife Department decided to reduce a chronically overabundant deer herd through antlerless deer harvests. While the deer herd is now in better condition, it still has the potential to grow and become overabundant. Landowner actions to improve deer habitats need to be coupled with the willingness to harvest antlerless deer in order to prevent deer overabundance. Deer overabundance has many costs that include degraded habitats and lack of forest regeneration, unhealthy deer, increased incidents of deer-vehicle collisions, crop and garden losses, and Lyme disease.

HABITAT REQUIREMENTS

Optimum deer habitat is a landscape mosaic of fields and forests. The average home range of a deer is approximately one square mile (640 acres) and this area must contain these various habitat conditions to best meet the needs of deer. During the critical wintering period when snows are deep, potentially from December 1 through April 15, it is essential that deer stay in wintering areas; forested areas containing stands of mature softwood trees with large contiguous crowns. Wintering areas range in size from about 10 acres to several thousand acres. They comprise less than 10 percent of the total forested area in the state. Even though the wintering area occupies such a minor component of the deer's home

➤ PAGE 82

range, it is by far the single most important habitat type. The best tree species are, in descending order of value, eastern hemlock, northern white cedar, red and white spruce, balsam fir, and white pine. Spruce and fir trees comprise the most common softwood tree that make up deer winter habitat in Vermont.

Preferred trees range in height from 35 to more than 75 feet, and from 6 to 20 inches in diameter at chest height.

Typically, the best deer winter habitat does not provide much food for deer because the low level of sunlight reaching the forest floor restricts the growth of young forest plants. Although deer rely greatly on their fat reserves to endure the winter, they still must eat throughout this stressful period if they are to survive until spring. Some mixture of hardwoods (deciduous trees) along with the softwoods (evergreen trees) provides some food along with cover. Optimum wintering areas have large softwood canopies interspersed with small (less than 1 acre) openings. Within these forest openings, succulent plants such as forbs and sedges, woody shrubs such as hobblebush, dogwood, witch-hazel, and striped maple, and young trees such as yellow birch, ash, maple, and hemlock provide deer with food in winter.

The amount of softwood required in wintering areas decreases in southern Vermont due to shorter winters. In southern parts of the state, deer often winter on steep south-facing slopes scattered with small groups of large softwoods.

Outside of the wintering period, deer can be found just about anywhere that shrubs and young trees interspersed with small grassy openings or forest edges next to fields and farm crops can be found. Unlike the winter period, deer tend to be adaptable to a wide variety of habitat conditions. In addition to an abundance of food resources, deer also need fawning habitat. This is typically areas of tall grass or shrubby cover that provides protection for fawns from predators.

Figures 18.2
Looking up at mature hemlock cover illustrating 70 percent crown closure

MANAGEMENT PRACTICES

Habitat management activities that provide food, escape cover, or winter shelter are recommended for landowners wishing to provide deer habitat. Because deer inhabit an area of more than 600 acres, most landowners shouldn't feel they must provide for every aspect of the deer's needs. If deer habitat management is a priority, most landowners should consider coordinating efforts with neighboring landowners.

Winter Habitat

Before you begin your management plan for deer, you should first determine if deer winter habitat (a.k.a. deer yards) exists on your property. Winter habitat is the cornerstone of the deer's annual life cycle in Vermont. Because deer return to the same wintering areas each year, often traveling many miles to access these important areas, evidence of their continued presence is recognizable to the trained eye. Look for the browsed twigs of young trees, indicated by the presence of compressed and bushy stems, as well as scarring on the stems of young trees, and concentrations of deer pellets. After a few weeks with more than 18 inches of snow, winter trails, concentrated deer pellets, and deer beds become evident in deer yards.

Deer yard maps are available from town clerks, regional planning commissions, and from the Vermont Fish and Wildlife Department. In addition, digital GIS maps of deer wintering areas are available on the Vermont Agency of Natural Resources Atlas; see **Resources** for links to more information. However, deer use of winter habitats may change

Because deer return to the same wintering areas each year, often traveling many miles to access these important areas, evidence of their continued presence is recognizable to the trained eye.

Figures 18.3a,b,c
Deer browse; bark stripping; trails and beds in snow

over time for various reasons, so inspect forest habitats after an extended period of deep snow depths to determine current deer usage. Contact your local Vermont Fish and Wildlife Department office for more information on assessing deer winter habitat. (For more information on managing deer wintering areas, refer to **Chapter 8, "Deer Wintering Area Management**.")

The primary goal of deer wintering area management is the promotion of softwoods. To improve deer wintering areas on your land, you should pursue two basic objectives. First, strive to retain and enhance mature softwood trees with large, vigorous crowns with winter canopy closure of 70 to 90 percent. These trees will be the ones that are most effective in reducing snow accumulation and wind chill. Second, provide a source of food by making small, selective patch cuts. Alternatively, you may want to clear-cut small strips of hardwoods adjacent to softwood cover which will promote tree and shrub regeneration and other herbaceous growth.

Without a deliberate approach to deer yard management, softwood stands can become too mature and overgrown. Overly mature, single-aged stands are more susceptible to disease and being blow down during storms. You should seek additional information from county foresters, private consulting foresters or state biologists in addition to reviewing the detailed management guide provided by the Vermont Fish and Wildlife Department. The link to download this document is in **Resources.**

Spruce, white cedar, and hemlock are optimal tree species due to their thick canopy and longevity. Fir and white pine are also acceptable and provide useful cover and capture sufficient snow to minimize snow depth within the wintering area. You may cut tall, dominant trees of these species if it releases a smaller tree of the same species. When selectively harvesting trees in a deer yard, take care not to damage non-target softwood trees. You may choose to harvest during the winter when regenerating trees are protected under deep snow cover.

Uneven-Age Stand Management

Maintaining functional cover in a deer yard usually requires uneven-age stand management with group selection cuts that range from .25 to 2 acres. Your goal should be to maintain at least 50 percent functional cover in a deer yard at all times. Stand entry should occur every 10 to 20 years, with stand maturity ages ranging from 60 years for predominantly fir stands, 80 to 100 years for predominantly spruce stands, and more than 100 years for hemlock stands. The amount of area to be regenerated is equal to the cutting interval divided by rotation age. For instance, in a stand on an 80-year rotation and treatment scheduled every 15 years, 15/80 (19 percent) of the stand should be regenerated during each treatment. Thus, only 38 percent of the stand would be 30 years old or less at any one time.

Even-age stand management with clearcuts, or preferably shelterwood cuts, larger than 1 acre may be acceptable in deer yards greater than 200 acres, but maintaining 50 percent cover at all times in the yard should still be your primary goal. For even-age management, shelterwood systems are a more reliable regeneration method than clearcutting.

In a two-stage shelterwood system, the first cut should be in late summer to prepare a seedbed for spruce regeneration and reduce residual stand damage during this bark-tight period. The second cut should be during winter to protect regeneration that has reached 6 inches to 3 feet in height, depending on brush competition. A three-stage shelterwood system is preferred when risk of wind-throw is high. Clearcutting is the least preferred strategy for deer yard management but you may find it necessary to quickly regenerate a nearly pure stand of fir or when dealing with Armillaria in certain situations. Regeneration should already be present, and logging should occur in winter with greater than 15 inches of snow depth to protect the seedlings.

With any harvest strategy, over-mature, diseased and insect-damaged trees should be cut first, but care should be taken not to spread disease. Wind-blown stands can also be salvaged. When converting an even-age stand to an uneven-age stand, remove the biggest fir first and leave spruce until the final cut of the first rotation because it lives longer, is more wind-firm, and is more resistant to spruce budworm.

Deer Yards

Hemlocks provide superior cover and can live up to 600 years; they are difficult to regenerate from seedlings in deer yards so landowners are advised not to harvest hemlock stands. However, there may be very little forage for deer under pure hemlock stands, so browse management in adjacent hardwoods should be a priority. You should release advanced hemlock regeneration where it exists, but avoid releasing hemlock regeneration prematurely as it is susceptible to sunscald and can cause die-back of the regeneration.

Narrow deer yards should not be fragmented, and yards should have corridors of cover that connect larger patches of cover. Such travel lanes are best if at least 200 feet wide. Permanent travel lanes, such as those along stream corridors, should be regarded as separate stands and managed very lightly so as to maintain maximum shelter value at all times.

Pre-commercial thinning may be done before a stand is 20 years old or 15 feet tall to encourage rapid tree growth and prevent stand stagnation. Aspen may be left uncut because it will eventually succumb to late-succession trees. Other hardwoods may be cut more frequently than softwoods to produce browse, but mature mast-producing trees (mast is nuts and fruits) such as beech, oak, and apple are desirable. Hardwood stumps cut low to the ground sprout more vigorously than those that are 1.5 to 2 feet tall.

Perhaps the simplest management practice you can follow to help deer survive winter is to not allow domestic dogs to roam free through deer yards and report such incidences of dogs chasing deer to the game wardens. Chasing deer throughout winter causes fat reserves to be expended prematurely, which leads to death before spring.

Maintaining the functional cover and safety properties of deer yards is important for long-term sustainability of Vermont's deer herd. Maintaining healthy habitats and healthy deer should help minimize the historical boom and bust cycle of the deer population. Deer yards are maintained on state lands by protection from development and with carefully planned timber harvests. Through the Act 250 review process, between 1,000 and 2,000 acres of deer wintering areas are protected every year by working

Perhaps the simplest management practice you can follow to help deer survive winter is to not allow domestic dogs to roam free through deer yards and report such incidences of dogs chasing deer to the game wardens.

➤ PAGE 85

The proper way to help deer forage in winter is by increasing availability of palatable woody browse from sucker-growth or tree-tops that result from pruning, apple-tree release, or logging operations.

with developers to mitigate adverse impacts on deer yards. However, most development and timber harvesting occurs on private lands with operations exempt from Act 250 review. It is largely up to private landowners and town planning boards to determine how the bulk of Vermont's deer wintering habitats are managed.

Winter Feeding

Artificial feeding of white-tailed deer is currently illegal in Vermont. While well-intentioned, this practice can actually reduce the animals' ability to survive the winter by making them more vulnerable to starvation, predation, disease, and vehicle collisions. Attracting deer away from wintering habitats can cause them to burn valuable energy and put them at greater risk of conflict with dogs, coyotes, and automobiles. Changing a deer's diet suddenly is a quick way to kill it. Deer have evolved to eat coarse browse with low digestibility in winter. Feeding deer corn or other high-carbohydrate foods can kill the microorganisms in their stomachs needed for proper winter digestion. Deer have been known to starve to death in winter with stomachs full of corn. When fed in winter, deer are often killed by humans with the best of intentions. The proper way to help deer forage in winter is by increasing availability of palatable woody browse from sucker-growth or tree-tops that result from pruning, apple-tree release, or logging operations.

Non-winter Habitat

Habitat management for deer outside wintering areas should meet the needs of the various life cycle activities. Manage small forest stands of less than 1 acre with trees less than 10 years of age through small clearcuts. Larger hardwood or mixed-wood clearcuts and shelterwood (understory) cuts are best for deer if irregularly shaped and less than 200 feet wide to provide deer with residual escape cover.

You should also maintain additional small herbaceous openings by mowing or brush hogging every 3 years. Log landings, permanent skid roads, wastewater leach fields, and other small openings can be seeded with legumes (such as alfalfa, clover, peas, and beans) and brassicas (cabbage and turnip type plants such as kale and rapeseed) as food-plots for deer. Such food sources provide protein and fat energy for lactating does and buck antler growth in the spring. Plant on south-facing slopes to encourage early snowmelt following severe winters when access to emergent vegetation may be critical for deer. Autumn brassicas will help deer build fat reserves for the upcoming winter; autumn body condition is essential for winter survival. Also, many brassica species become palatable after one or two frosts, which usually coincide with archery season. Such food-plots can enhance bowhunters' success, particularly where localized deer overabundance is an issue for garden, crop, or forestland damage. When localized population reduction is the objective, antlerless deer should be targeted by bowhunters.

Active farmland within deer home range is one of the best complements to their natural habitat. While agricultural crops such as alfalfa, oats, and corn promote poor health in a deer's winter diet, they are perfect supplements to a deer's spring and summer diet. During autumn, beech and oak trees become an important source of food. The nuts, called hard mast, make a vital contribution to deer's fat reserves and their chances of surviving the winter.

Beech and oak trees begin producing nuts at about age 50, and continue to do so at regular 3- to 5-year intervals for up to 150 years. In most regions of the state, beech and oak are found sparingly; oak is more common in the river valleys while beech is found in the upland forests. Both species often grow in small homogeneous groups within the forest. You should practice selection harvests that maintain and enhance the crowns of mature trees and promote the regeneration of future mast producers, removing trees with bark disease evident on the stems first.

Apples, blueberries, and other soft mast–producing plant species can be managed to provide fruits to supplement the deer's fall diet. Remove trees that shade these plants; most soft mast producers require full or nearly full sunlight to remain vigorous and productive. While existing plants are easiest to enhance, apple, blueberry, and other fruit plants can be purchased from local nurseries and raised to provide food for deer. Some types of apple trees will hold apples well into winter.

The Natural Resources Conservation Service may in some cases provide landowners with financial assistance for habitat management through Farm Bill Conservation Programs. Deer habitat improvements are easily combined and complementary with other direct managements for other species of greater conservation concern.

In areas where deer have become overabundant, successful regeneration of desirable tree species such as white ash, red oak, and maples may become uncommon or nonexistent. Large clearcuts in such areas can help establish desirable regeneration of species that are palatable to deer by overwhelming deer with enough browse and ensuring that some seedlings escape consumption by reducing browsing pressure on seedlings that grow through the remaining slash.

RESOURCES

Vermont Agency of Natural Resources Atlas. http://anrmaps.vermont.gov/websites/anra/

Vermont Fish and Wildlife Department. "Management Guide for Deer Wintering Areas in Vermont." http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/Management%20Guide%20for%20Deer%20Wintering%20Areas%20in%20Vermont.pdf

—. "Guidelines for the Review and Mitigation of Impacts to White-tailed Deer Winter Habitat in Vermont." http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/Guidelines_for_the_Review_and_Mitigation_of%20Impacts_to_White-Tailed_Deer_Winter_Habitat.pdf

—. "Vermont Fish and Wildlife Big Game Management Plan for Deer." http://www.vtfishandwildlife.com/library/reports_and_documents/Hunting_and_Trapping/big_game/Big_Game_Management_Plan_%202010%20-%202020/_Chapter%202%20-%20White-tailed_Deer.pdf

➤ PAGE 87

19. MOOSE

Alces alces

The best moose habitat in Vermont occurs in the forests of the Northeast Highlands and along the entire spine of the Green Mountains.

SUMMARY

Moose are large animals that are well adapted to the thick forests and deep snow found in the mountains and highlands of Vermont. They are generally solitary and males may roam great distances during the fall rut. Moose are semi-aquatic and require ponds, bogs, and stream habitats for food and to maintain body temperature in the summer. They also require regenerating forest for food, upland hardwoods for food and cover, and thick softwood stands for wintering habitat.

NATURAL HISTORY

Moose are Vermont's largest wild animal. Adults may stand 6 feet or taller at the shoulder and weigh between 600 and 1,200 pounds. Moose are able to lift their feet nearly shoulder high to move easily over fallen trees or through deep snow.

Historically, moose were plentiful in Vermont until the nineteenth century when widespread clearing of forests and subsequent conversion to farmland eliminated most of the state's moose habitat. Moose became so rare in Vermont that by 1896 the Legislature afforded the animals complete protection. The moose population has since responded to the re-growth of forests and now occupies three-quarters of the state. The best moose habitat in Vermont occurs in the forests of the Northeast Highlands and along the entire spine of the Green Mountains.

Moose generally occupy distinct seasonal home ranges to which they return from year to year. Summer ranges are about 4 to 10 square miles in size. Home ranges may expand during the fall mating (rutting) season and decrease in the winter. Moose are not territorial and individual ranges overlap considerably.

Moose are not as gregarious as deer and, although it is not uncommon to encounter several moose together during the post-rut period, by late winter moose are usually seen as solitary animals or in groups of two or three. Bull moose generally do not associate with cows except during breeding season (September to November). Although usually one bull is seen with a cow, occasionally two or more bulls follow a cow in heat.

Bulls in their prime (ages 6 to 9 years) reach the peak of the rut earlier than younger bulls, and due to their size, strength, and social dominance, are more successful breeders. The larger antlers of prime bulls are shed after the rutting season, usually in late November or December. Young bulls may retain their smaller antlers as late as mid-April.

Calves are born from mid-May through early June. Younger cows (ages 2 and 3 years) generally give birth to a single calf, but twins are common for older cows if adequate browse is available. Just prior to calving, pregnant cows drive away their offspring of the previous year.

➤ PAGE 88

Moose are mainly browsers, eating new leaves and the twig growth of trees and shrubs, but they also graze on grasses, forbs, lichens, and mushrooms. Tender shoots of water lilies and other aquatic plants are sought during the summer because of their high concentrations of sodium, a mineral necessary for lactation, antler growth, and rapid body growth of calves. Moose are excellent swimmers and occasionally dive to feed on plants in deep waters. An adult moose may eat up to 100 pounds (green weight) of high-quality food per day in the summer. After the fall frosts and winter snows either kill or cover up herbaceous foods, moose turn to woody twigs for food until the next spring.

Winter browse is neither very nutritional nor easily digestible. Consequently, moose on winter range usually lose weight and must rely on fat reserves to survive harsh winters. Moose in the Northeast browse on aspens, maples, birches, willow, ash, pin cherry, hobblebush, and balsam fir. Scars from winter bark stripping remain on trees for many years.

Figures 19.1
Moose feeding in a wetland

HABITAT REQUIREMENTS

The moose is a northern forest species and utilizes different habitats during various seasons of the year. In general, moose prefer thick, brushy habitat for concealment and as sources of abundant food.

Lowland softwood forests, beaver ponds, and other shallow bodies of water are favorite spring and summer habitats for moose. During the hot summer months, moose can suffer from overheating and must have access to dense shade or water for cooling. Moose also use ponds to escape biting insects and predators.

Upland hardwood or mixed forests are frequented by moose during the fall and winter. Younger age classes of these forest types provide abundant browse, especially in recently logged areas. Optimum year-round moose habitat for their region consists of:

- 40 percent feeding grounds (regenerating forest less than 20 years old),
- 10 percent winter cover (spruce and fir stands more than 20 years old),
- 40 percent hardwoods or mixed forest greater than 20 years old (for both food and cover), and
- 10 percent wetlands (for summer feeding and cooling).

These conditions are believed capable of supporting a density of five moose per square mile.

In Vermont, increasing moose densities from 1980 to 2005 resulted in growing conflicts with humans, namely collisions with motor vehicles and damage to livestock fencing and maple sap tubing. During this same time period, in the Northeast Kingdom, moose densities greater than three per square mile caused widespread damage to regenerating forests. Not only did this heavy browsing reduce future economic returns for forest landowners, but habitat conditions for many other species of wildlife that utilize shrubs and dense forest understory for feeding, nesting, brooding, and escape cover were negatively affected.

Experience has shown that because of these conflicts with human land uses and damage to the environment, moose densities throughout Vermont shouldn't be higher than two moose per square mile, and public surveys indicate that less than one moose per square mile is generally more acceptable. Adequate forage for moose at these lower densities can be provided by lowering the amount of regenerating forests to 10 to 20 percent.

Figures 19.2
The combination of wetlands, softwoods, and hardwoods makes good moose habitat. Courtesy of Eric Sorenson, VFWD.

Figures 19.3
Aerial photo of moose habitat showing wetlands and softwood forest. Courtesy of John Hall, VFWD.

Ten to 20 percent of moose range should be in regenerating forest (trees up to 20 years of age).

MANAGEMENT PRACTICES

Managing habitats specifically for moose is difficult because of the animal's large home range. Few landowners have the ability to control habitat management over an animal's entire 8 to 16 square miles. Nonetheless, you can maintain or improve specific moose habitat attributes under your control by applying a few general guidelines:

1. Moose generally benefit from the abundant browse that grows on recently logged areas. Ten to 20 percent of moose range should be in regenerating forest (trees up to 20 years of age).
2. Although clearcuts provide plenty of food, moose prefer to remain close to cover and their use of browse in the interior of large cut areas is low, particularly during the winter. Square clearcuts, therefore, should not exceed 10 acres in size. Larger rectangular or irregularly shaped clearcuts are acceptable as long as the maximum width is kept below 200 yards.
3. Softwood stands managed as winter shelter should comprise 5 to 15 percent of a moose's home range and should be located adjacent to regenerating hardwood or mixed forest (browsing areas) at elevations higher than 1,000 feet (where most Vermont moose winter). These shelter areas should be at least 10 acres in size with a moderately dense overhead canopy and average tree heights of at least 35 feet.
4. You should also protect any existing shallow wetlands, such as beaver ponds, used by moose. Manage these wetlands as indicated by **Chapter 24, "Beaver."**

Figures 19.4 ►
Recent clearcut with good regeneration

20. BLACK BEAR

Ursa americanus

SUMMARY

Black bears inhabit remote forested habitats throughout much of Vermont. They require large tracts of unfragmented landscapes with a variety of food sources. In the spring, emerging succulent plants such as jewelweed, often associated with forested wetlands, as well as plants such as Jack-in-the-pulpit are critical for bear survival. At other times of the year, bears rely on fruits and nuts such as apples, acorns, mountain ash berries, and beechnuts to add fat stores for winter dormancy. Maintaining white clover food plots, releasing and retaining old apple trees, and maintaining intact beech and oak stands are all recommended to promote black bear populations. A forested buffer around wetlands is also critical when managing for bears. The most important habitat management consideration for black bears, however, is to avoid fragmenting remote forested habitat so they have refuge from humans and are able to move over wide areas and find food and mates.

Maintaining white clover food plots, releasing and retaining old apple trees, and maintaining intact beech and oak stands are all recommended to promote black bear populations.

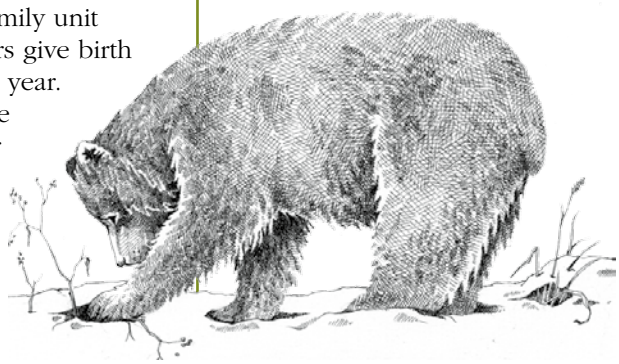
NATURAL HISTORY

The black bear is Vermont's only species of bear and is the only bear species that occurs east of the Mississippi River. Adult female black bears are commonly 150 pounds, while adult males often weigh 200 pounds or more. Black bears have bulky bodies and short, stout legs that can carry them more than 25 miles per hour for short distances.

Black bears are well known for their acute senses of hearing and smell. The snap of a twig or a slight change of wind bringing human scent causes a bear to flee immediately. Bears are quite intelligent, but their behavior can be unpredictable so they should always be given a respectable distance when encountered.

Black bears are inherently wary due to a long history of hunting in Vermont. Bear bounties lowered bear populations to an estimated 100 to 200 animals statewide until the bounties were ended in 1941. Today, Vermont's bear population is carefully managed and has expanded to where bears are common in most towns that have large tracts of forest. Under the Vermont Fish and Wildlife Department's Big Game Plan (2010–20), the statewide bear population goal is to maintain the population between 4,500 and 6,000 animals.

Black bears are solitary creatures outside of the breeding season in early summer. Several bears together are almost certainly a family unit when spotted outside the breeding season. Female black bears give birth to an average of two cubs in mid- to late January, every other year. Only 8 to 10 ounces at birth, cubs weigh 6 to 8 pounds by the time they emerge from the den in April. Only the female bear cares for the young; she is extremely attentive and vigorously defends them. The cubs remain with their mother through the year and into the following spring until the female once again comes into season during the June to July breeding season.



➤ PAGE 91

HABITAT REQUIREMENTS

Black bears are creatures of the forest, and except for large timber company holdings and some public lands, few people own sufficient acreage to satisfy all of the annual home range requirements of black bears. The annual home range of a female bear may comprise 10 to 25 square miles, and the home range of a male black bear may extend 50 square miles or more. Smaller parcels may still be important, however, if they contain critical feeding habitat, are very remote, or contain safe travel corridors.

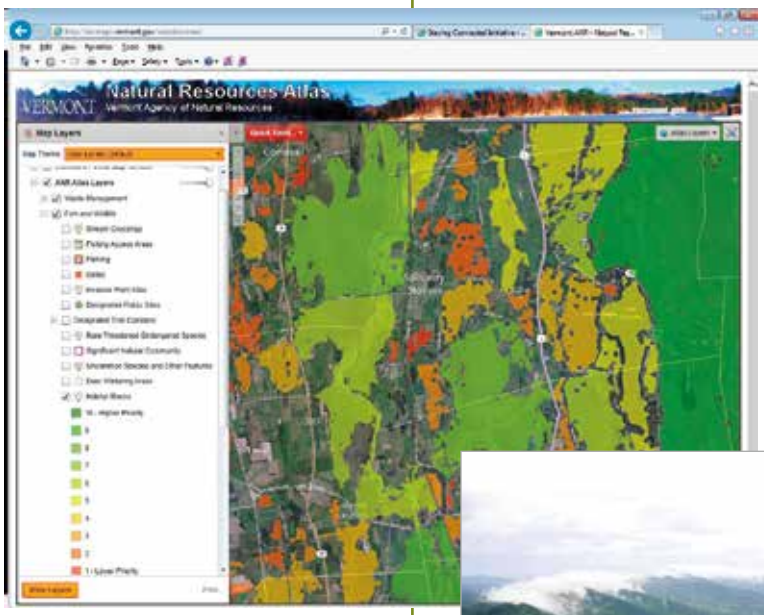


Figure 20.1
Map of large forest block

Unlike white-tailed deer, which may flourish in fragmented habitats and close to civilization, black bears are intolerant of both. Distributed along the length of Vermont's Green Mountains and in the remote areas of northeastern Vermont, bears haunt remote forests. Ransacking excursions close to civilization are the exception rather than the rule. Construction of roads, buildings, or other developments that encourage permanent or seasonal human occupation, diminishes or excludes the presence of bears.

Even though the cover of forested remote areas is one of black bears' greatest habitat needs, bears also require water and food. Wide-ranging bears have little trouble fulfilling their needs for water in Vermont's forests, but their food requirements vary seasonally and when in short supply, can be life-threatening. The size of a bear's home range is directly related to the productivity of the habitat; if bears have to search far and wide to satisfy their annual requirements, the annual home range is much larger.

Figure 20.2
Wetlands with sedge and jewelweed

Few Vermont animals have food habits as diverse as black bears. Black bears are typically thought of as carnivores, and while they do eat some meat, black bears are principally herbivores. Bear diets vary seasonally, and spring is the most difficult period for Vermont's black bears. When the bears first emerge from their dens in late March or April, food supplies are scarce. Although bears may feed on evergreen needles, buds, roots, bulbs, carrion, and over-wintered acorns and beechnuts, they usually must turn to the succulent, emergent vegetative growth of wetlands and seeps. Forested wetlands often provide the only food bears will have during their first month or two out of the den, and bears may perish if their fat stores are depleted in spring or they are unable to find adequate access to wetlands.

As spring progresses, more and more herbaceous plants appear and bears may become grazers of lush meadowlands — particularly secluded fields or forest openings. Being opportunistic feeders, bears will occasionally eat the eggs or young of low nesting birds, rodents, or other animals.

During the summer, bears have a greater choice of foods such as raspberries, blackberries, blueberries, wild cherries, hazelnuts, and insects. Course woody debris on the forest floor provides cover for insects and

larva thereby providing a valuable food source to bears. Roots and tubers are also a food source for Vermont bears, particularly plants such as Jack-in-the-pulpit and jewelweed. Wetlands continue to provide an important food source for bears as well as areas for cooling off and for seclusion. Found in wet areas until frost arrives, the orange-flowered jewelweed plant may be consumed to ground level by feeding bears.

In autumn, bears enter a state of 'hyperphagia,' or a heightened feeding state, as they frantically attempt to store sufficient fat to carry them through the 5 to 6 months of winter. Bears may become more visible as they expand their range looking for fruits and nuts. Apples are a staple as are mountain ash berries, where available. Beechnuts, acorns, and other hard mast (nut) crops are especially critical to bear survival and reproduction as they are highest in fat content and allow bears to quickly build up fat supplies.

Figure 20.3
A bear's diet consists of apples, mountain ash berries, beechnuts, and acorns.

Unless a shortage of food supplies force them to den early, black bears begin their search for denning sites late in the fall. Bears may den in mountain ledges, hollow logs and trees, partially uprooted trees, lowland brush piles, or excavate dens between the roots of large trees. Denning needs of bears are sufficiently flexible that virtually any forested habitat can provide den sites. By late November or early December, Vermont's bears are denned for the winter.

HABITAT MANAGEMENT

You can improve habitat for bears on your land by adopting practices that increase the diversity of the forest as well as the diversity and abundance of bear foods. Prior to any active management, you should develop a map of existing habitat conditions on your property and then create a plan to maintain and improve those habitats. Small clearcuts (from 1 to several acres in size) can create sunlit openings for the development of herbaceous growth and early successional fruiting plants such as berries and cherries. Decayed stumps and logs from logging debris provide insects for foraging bears. Trees with large cavities should be retained whenever they occur as they are favored by bears as well as many other animals for denning and nesting.

You can also create long-term, 1-acre openings by bulldozing, seeding, and maintaining clovers and grasses (see **Chapter 11, "Wildlife Food Plot Management"** for specific information on food plots and resources). Occasional mowing or brush hogging during the growing season will prevent invasion of woody plants and ensure tender, young grasses and forbs on which bears feed. Woods roads and managed openings should be seeded and maintained in grass cover. Burning cycles of 3 to 5 years will maintain species such as blueberries and improve palatability and nutrition of understory plants, while removing shrubs and trees that suppress desirable herbaceous growth. Raspberries and blackberries can persist in dense stands under power line rights-of-way for decades. Contact your power company forester to ensure that the open space is managed to produce and maintain fruiting plants preferred by bears and other wildlife.

If you can have concentrations of beech and oak trees utilized by bears you should exercise caution when logging on the periphery of these areas. Concentrations of beech trees showing evidence of recent and historical use by bears may be a critical food source for many bears. In general, the greater the evidence of bear use (claw marks on the trunks,

Photo courtesy of Donna Pollard

The release, protection, and fertilization of soft mast-producing crops will promote and assure bear use.

"bear nests" in tree crowns), the greater the value of those trees to bears. Bears' use of oak is not as easily distinguished. Claw marks on the bark are not readily apparent, and the bears may not create "nests" of broken branches as they do with beech. Bears may simply "windrow" piles of leaves as they pick acorns off the ground. If you suspect or know that your beech or oak stand is being utilized by bears, it is recommended that you enlist the advice of a wildlife biologist or forester for site-specific recommendations on how to maintain and improve these important wildlife trees. However, a good rule of thumb is to maintain all healthy beech and oak trees in a variety of age classes in order to ensure that they continue to provide food for bears and other wildlife for many years (see **Chapter 9, "Beech Mast Production Management"** for more information on managing American beech for mast production).

Abandoned farmland offers an ideal mix of food and cover for bears, particularly lands where apple trees, chokecherries, black cherries, and other food-producing shrubs abound. The release, protection, and fertilization of soft mast–producing crops will promote and assure bear use. Nut-producing trees should be released and retained. Bears are notoriously crude in their feeding habits, crushing plants and breaking branches. When attempting to grow new apple trees you should remove the first few crops of apples while they are still green to prevent black bears from damaging the young limbs in their attempts to get to the fruit.

When implementing habitat improvement practices, you must keep in mind the bears' need for cover and seclusion. Cover is not a necessity for protection from the weather as much as a means of concealment. It is essential that sufficient forested or vegetative cover be provided to and from food sources as a travel corridor.

Protection of forested wetlands can be as important as increasing other food supplies. Cover (preferably softwood) around wetlands and allowing secluded travel to and from them is important. Bears are also attracted to wetlands during the summer months where they can cool off in the water and bed in the surrounding dense softwood cover. A minimum 100-foot undisturbed buffer is recommended around forested wetlands when managing for bear.

Before you begin habitat improvement practices for bears, be certain that your property is within bear range (contact any district Agency of Natural Resources Office for this information or go to the website shown in **Resources**). Even if your property is mapped as "Occasional Use" bear range, you may have critical habitats worthy of management and protection. Keep in mind that many of the habitat practices intended to benefit bears will also benefit a variety of wildlife species — birds as well as mammals.

RESOURCES

Hammelin, P. 2011. "Beech Management Guidelines." Waterbury, VT: Vermont Fish and Wildlife Department.

Hammond, F.M. 2002. "The Effects of Resort and Residential Development on Black Bears in Vermont." Final Report. Waterbury, VT: Vermont Fish and Wildlife Department, Agency of Natural Resources.http://www.vtfishandwildlife.com/library/Reports_and_Documents/Fish_and_Wildlife/VT%20ANR%20Beech%20MPA%20Guideline%203-22-2011.pdf

Vermont Agency of Natural Resources Atlas. http://anrmaps.vermont.gov/websites/anra/

Vermont Fish and Wildlife Department. 2010. *Big Game Management Plan 2010-2020. Creating a road map for the future.* 75 pages.

21. GRAY SQUIRREL

Sciurus carolinensis

SUMMARY

Gray squirrels live primarily along the Lake Champlain and Connecticut River valleys in Vermont in hardwood forests of oak, hickory, and beech. They require mast-producing oak trees in conjunction with other mast- or seed-producing trees (see wild turkey and mast tree sections of these guidelines for more information). As a landowner, you can promote gray squirrel populations on your land by selectively thinning around large, prolific hard mast trees and by leaving several trees with small cavities for den sites.

NATURAL HISTORY

Gray squirrels are not only found in backyards but also in mature hardwood forests dominated by hard mast-producing trees such as oak, hickory, and beech. Gray squirrels seldom utilize pole stage hardwood or pure softwood stands, unlike red squirrels. Although gray squirrels can be found throughout much of Vermont, the best habitat and highest populations occur in the oak-dominated hardwood forests of the Champlain Valley, Connecticut River Valley, and southern Vermont.

Home ranges of gray squirrels vary from 1 to 25 acres depending upon habitat quality. Normal daily movements average only 160 feet.

Squirrels reach sexual maturity at 8 to 11 months. They undergo two breeding periods each year in January and June. The gestation period is 60 days, with litter size normally two or three blind and hairless young. Food availability greatly influences survival and reproductive success. In good food years, up to 40 percent of females produce second litters; in poor years, almost none will. Average life expectancy for a squirrel is 1 to 2 years, although some individuals may live up to 10 years. Annual mortality rates average 50 percent for adults and 75 percent for juveniles.

Gray squirrels feed on a variety of foods including acorns, nuts, seeds, buds, flowers, fungi, insects, and small bird eggs. Hard mast (acorns, hickory nuts, and beechnuts) makes up the bulk of their diet throughout the year and is critical to their survival. Several consecutive years of mast failure can trigger increased movements of squirrels in search of food, resulting in heavy mortality. During such times, populations can drop by 15 to 25 percent, though they may recover to former levels after a couple of good mast years.

HABITAT REQUIREMENTS

In Vermont, good gray squirrel habitat consists of mature hardwood forest with a high component of oak, in combination with hickory or beech. A closed or nearly closed canopy is also necessary. The availability of alternate food-producing trees such as ash, maple, butternut, hop hornbeam, and black cherry can buffer against years of poor mast crops.

Den trees provide winter shelter, escape cover, and nest sites. Squirrels select cavities that are 1- to 3-feet deep and 6- to 10-inches in diameter with entrance holes 3- to 4-inches wide. Gray squirrels avoid larger

Although gray squirrels can be found throughout much of Vermont, the best habitat and highest populations occur in the oak-dominated hardwood forests of the Champlain Valley, Connecticut River Valley, and southern Vermont.

➤ PAGE 95

Figure 21.1
Lowland hickory and oak forest are excellent gray squirrel habitat.

entrance holes because these allow raccoons to enter their dens. Leaf nests are constructed to provide alternate escape and nesting cover, but cavities provide better shelter than leaf nests.

A permanent source of water such as woodland streams and ponds, is important to squirrels, especially lactating females.

MANAGEMENT PRACTICES

In Vermont, the best management opportunities for gray squirrels are in mature hardwood forests and woodlots dominated by oak. The presence of mature hickory and beech in these stands further enhances their value. Gray squirrels can be managed for in woodlots as small as 5 to 10 acres. Gray squirrel density of one per acre is a reasonable goal in good habitat, with two to five per acre possible in the very best habitats. Small woodlots, riparian zones, and field borders can be managed for gray squirrels if they are 5 acres or more in size, at least 50 feet wide, and have nearly complete crown closure.

A minimum of 150 pounds of acorns and nuts per acre is required to maintain viable gray squirrel populations and accommodate use by other wildlife (more than 80 species of birds and mammals are known to feed on acorns alone). To provide this amount, trees producing hard mast must be a major component of the forest stand. Quality habitat should have two or more primary hard mast tree species plus several alternate food species to buffer against poor mast crop years. Stands of mixed hardwoods or hardwoods and pine can be improved by selective thinning. Mark trees in the autumn to identify and favor the best mast producers. To promote crown vigor and increase mast production, select trees with crowns equal in feet to twice the diameter of the tree's base in inches (example: a 16-inch tree should have at least a 32-foot crown width). During thinning, release the best mast producers, but retain a diversity of mast species. Areas managed for gray squirrel will benefit a variety of wildlife.

Provide at least two to five den trees per acre, distributed throughout the managed area. Den tees should be live, durable hardwood species ten inches or greater in diameter with holes 3- to 4-inches in diameter.

RESOURCES

U.S.D.A. Natural Resources Conservation Service. "What is Forest Stand Improvement?"http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081110.pdf

—. Forest Stand Improvement Job Sheet (666) – Mast Tree Release.http://efotg.sc.egov.usda.gov/references/public/VT/JS666VT_(Mast)_FillableForm.pdf

22. SNOWSHOE HARE

Lepus americanus

SUMMARY

Snowshoe hare are targeted by recreational hunters but they are also an important prey item for many species of wildlife. Snowshoe hares are most often found in large unbroken patches of young softwood and mixed-forest stands, particularly in northern and high-elevation climates with deep winter snowpack. They require a mosaic of densely forested and open shrublands, and thrive in areas with large numbers of woody stems and berry bushes.

NATURAL HISTORY

Snowshoe hare are an important part of the ecosystem because of their role as prey for so many wildlife species, including coyote, fisher, bobcat, lynx, great horned owl, and marten. Although, sometimes referred to as a rabbit, the hare has characteristics that are very different from the cottontail. The back feet of a hare are much larger than a rabbit's (hence the "snowshoe"), allowing it to travel through deep snow. Unlike the rabbit, the hare turns white in winter, an adaptation that allows it to blend in with a snowy environment. The hare's young are born fully furred with their eyes open, whereas rabbits are born blind and naked. These adaptations allow snowshoe hares to thrive in northern and upper elevation climates where cold and snow make survival for the cottontail much more difficult.

Snowshoe hares are active at dawn, dusk, and throughout the night. During the day they take cover under exposed tree roots, ledges, clumps of small trees, or under logs; shelter spots referred to as a "form."

Young hares are born from May through August in litters that vary in size from one to six. A female produces one to three litters per year. After winters with low temperatures and high snow accumulations, litters tend to be larger. Snowshoe hares are promiscuous breeders, and males sometimes fight each other to the death during the breeding season.

HABITAT REQUIREMENTS

Optimal hare habitat occurs in and around young softwood stands. Dependence on softwood is related to hares' need for concealment and thermal cover. The more difficult it is for a predator to see through a forest stand, the better the area is for hare. Understories with high stem densities that result in cover of greater than 60 percent to 85 percent, provide optimal habitat for snowshoe hare in winter. All of the habitat needs of a snowshoe hare should be met within a 20-acre home range. Extended periods of low temperature can impact hare survival due to the fact that they rely on limited fat reserves.

In boreal forest habitats to the north, hare populations exhibit 9- to 11-year density cycles generally assumed to be linked to lynx and other predator populations. Although the cycling may occur in Vermont, it appears to be less pronounced than in northern boreal forests.

Snowshoe hare are an important part of the ecosystem because of their role as prey for so many wildlife species, including coyote, fisher, bobcat, lynx, great horned owl, and marten.

Figure 22.1
Softwood stands make optimal snowshoe hare habitat.

➤ PAGE 97

Softwood cover is the single most important habitat need for snowshoe hare

When hare populations are at their highest point, good habitat could support an excess of one hare per acre.

Food requirements of the hare shift seasonally. Hare are able to adapt to whatever vegetation is close to the cover they require. In summer, herbaceous plants such as clover, grasses, and ferns are favored. Berries and the succulent parts of woody vegetation are also consumed in summer. Winter foods include twigs, buds, tender bark of shrubs and small evergreen trees, stems of berry bushes and seedlings of alders, aspens, spruces, hemlock, balsam fir, birches, willows, white pine, and cedar. Small scattered openings adjacent to softwood cover improve survival by reducing travel distances to food.

Softwood cover is the single most important habitat need for snowshoe hare and can be described as having two basic components:

- "Base Cover" is the dense conifer cover from 8 to 16 feet in height where hare spend the day.
- "Travel Cover" consists of softwood corridors or tracts that allow hare to move from base cover to a food source. Travel cover is not necessary if browse supplies are available immediately adjacent to base cover. Good travel cover effectively increases the range over which a hare may roam safely in search of browse.

Within the snowshoe hare's 20-acre home range, the following conditions provide optimal habitat (can be extrapolated over a larger area):

1. Maintain at least 20 to 50 percent of the stand in base cover of trees 8 to 16 feet in height.
2. Maintain 30 to 50 percent of the area in travel cover. In spruce/fir stands, optimum cover will average 30 years and older, and from 16 feet in height until the stand is harvested.
3. Plan for 5 to10 percent in permanent herbaceous vegetation such as grasses and forbs for a source of summer food, maintained in .25-acre openings scattered around the unit.

The habitat requirements that target snowshoe hare should be balanced with the optimal needs of other species that require older forests. Managing at the landscape level to provide areas of large unfragmented forests and coarse woody debris for species such as marten, some neotropical songbirds, and wintering deer should help to guide where management for snowshoe hare occurs.

➤ PAGE 98

23. EASTERN COTTONTAIL RABBIT

Sylvilagus floridanus

SUMMARY

Vermont has two species of rabbits; the nearly extirpated New England cottontail and the eastern cottontail. Eastern cottontails are found mostly in Vermont's southernmost portions, as well as along the Champlain Valley and Connecticut River Valley. Cottontails require thick cover to hide in, particularly during the winter when they are not well camouflaged due to their brown coats. Maintaining thick hedgerows and early successional forest as well as brush piles and hay or croplands is the best way to manage for cottontails.

NATURAL HISTORY

Vermont historically has been home to two species of cottontail rabbit that look so similar that they are almost impossible to tell apart in the field. The New England cottontail rabbit, *Sylvilagus transitionalis*, is a native species which has resided in this state since pre-colonial times, but which is extremely rare today due to changes in habitat. The eastern cottontail rabbit, *Sylvilagus floridanus*, occurs throughout the United States. It was introduced into New England in the 1800s and is now common in Addison, Rutland, and Bennington counties. It is less common in Chittenden and Grand Isle Counties. Eastern cottontails have moved up the Connecticut River Valley from Massachusetts in recent decades.

HABITAT REQUIREMENTS

Eastern cottontail habitat is found in the valley farmland region where fields and pastures are interspersed with hedgerows and low, dense brush. Winter is the most difficult time of year for rabbits. In Vermont, snow cover limits the distribution and densities of the cottontail population. Because they are poorly camouflaged in snow, they need thick winter cover in which to hide. Because preferred foods such as agricultural crops and herbaceous plants are not available in winter, they depend on low-growing woody vegetation for food as well as for escape cover and thermal cover.

The average home range size for the eastern cottontail rabbit is 10 acres; although in high-quality habitat it may be much smaller. The cottontail tends to inhabit the same home areas throughout its life, although it may range in a smaller portion in winter when cover availability is lowest. Home ranges of rabbits tend to overlap, particularly in the best habitat.

Cottontails will select areas of better cover over areas with abundant food if both are not found together. Rabbits have two different cover requirements: feeding cover and resting/escape cover. Dense woody vegetation can provide adequate summer cover but, in order for the rabbit to survive the Vermont winters, dense woody vegetation such as that found in old fields is critical. Clean farming and a lack of brushy fence rows in agricultural fields has led to the decline of the eastern cottontail rabbit in Vermont since the 1940s. Because of the animal's need for cover throughout its life cycle and the yearly seasons, cover availability

Maintaining thick hedgerows and early successional forests as well as brush piles and hay or croplands is the best way to manage for cottontails.

Figure 23.1a and b
New England cottontail (top) and Eastern cottontail (bottom)

➤ PAGE 99

Not finding this photo. Please resend.

Figure 23.2
Cottontail habitat often consists of fence rows with shrub habitat. Courtesy of John Gobeille, VFWD.

is the most limiting factor for cottontails. Cover is also important for the rare New England cottontail rabbit. However, it seems to prefer dense understory in regenerating woodlots or shrubby wetlands. The isolation of these patches of habitat may have led to extinction of local populations of New England cottontails.

MANAGEMENT PRACTICES

Because the eastern cottontail is truly a species associated with old fields and edge-type habitat, woody vegetation interspersed in agricultural fields provides the best habitat. Maintenance and enhancement of hedgerows is an important practice for the species. Hedgerows should be of dense woody vegetation 3 to 6 feet high and at least 20 feet wide. Mowing adjacent to hedgerows further enhances the habitat. Old fields reverting back to forest also provide the critical cover requirements of cottontails. In the Champlain Valley, brushy areas of gray dogwood, prickly ash, red cedar, and low-growing juniper near mowed meadows of grasses and legumes provide optimal conditions for eastern cottontails. Pastures containing red cedar and low-growing juniper provide excellent habitat.

Within every 10-acre area, all of the following habitat requirements of the eastern cottontail rabbit should be available:

1. Between 20 and 75 percent of the managed area should be maintained as brushy cover. Reverting field or pasture should be kept in early successional stages by actively mowing, burning, or light grazing on half of the area every 5 to 10 years.
2. Areas lacking early successional habitat can be enhanced with brush piles, or log or stump piles. Piles should be 3 to 7 feet high and 13 to 20 feet in diameter. Place them adjacent to edges of fields, pastures, and woodlots, spaced 50 to 100 feet apart. Brush piles will break down in 3 to 5 years, so one-quarter of them should be replaced annually.
3. The remaining acreage should be composed of hay or cropland and/or deciduous forest.

If you are considering managing your land for rabbit habitat, you should create or maintain a matrix of woody vegetation and herbaceous vegetation. Land is enhanced for rabbits when brushy cover is distributed throughout the area and not concentrated in one large block. Densities of one to three cottontails per 2 acres can be expected under optimum habitat conditions.

24. BEAVER

Castor canadensis

SUMMARY

Beavers play an important role in creating wetland habitat for many other species of wildlife. Ducks, songbirds, reptiles, amphibians, moose, bears, and insects all use beaver-created wetlands. Practically any habitat that is suitable for beavers will soon have a resident population. They eat bark and small woody shoots. Beaver habitat can be enhanced through selected cutting along streambanks in order to regenerate small-diameter woody vegetation. Beaver activity can create problems for some landowners due to their ability to flood areas. Landowners dealing with problems from beavers may choose to implement methods of water-control or tree protection, because removing individual beavers does not usually solve the problem.

NATURAL HISTORY

Beaver are referred to by biologists as a keystone species because they can dramatically affect ecosystem structure and dynamics. Wetlands created by beaver can benefit a landowner in a variety of ways, from creating habitat for wildlife species such as fish and waterfowl, to controlling downstream flooding and filtering sediment to improve water quality.

Beaver are referred to by biologists as a keystone species because they can dramatically affect ecosystem structure and dynamics.

Figure 24.1
Beaver within a beaver-influenced wetland

Beaver were removed from most of New England by the early 1800s due to unregulated harvest and habitat degradation. Beavers eventually made dramatic recoveries following wildlife agency reintroduction programs and habitat regeneration starting in the 1920s. However, many of Vermont's roads and villages were developed after beaver were eliminated from the state and were located with little regard to the location of potential beaver habitat. Not surprisingly, as both the beaver and human populations have expanded throughout the latter part of the twentieth century, there has been a corresponding increase in conflicts.

Beavers are one of the few animals capable of modifying their habitat to meet their needs, constructing elaborate dams, lodges, and bank dens and storing food for winter retrieval. Beavers live in family groups comprising a monogamous adult pair, three to four newborn kits, and kits from the previous year. Beavers do not readily accept unrelated beavers into their family groups.

Beaver-created wetlands are focal points for many other wildlife species, including muskrats, otters, raccoons, and moose. Birds such

➤ PAGE 101

Figure 24.2
Wood ducks enjoy beaver-made wetlands. Courtesy of George Gentry, USFWS.

Beaver ponds are so important to waterfowl that the return of the beaver in New York State resulted in the production of about 60,000 more ducklings annually.

as mallards, wood ducks, black ducks, red-winged black birds, and great blue herons thrive in these small wooded wetlands. Beaver ponds are so important to waterfowl that the return of the beaver in New York State resulted in the production of about 60,000 more ducklings annually. Many amphibian and reptile species also benefit from the modification of wetlands by beaver which are an important food source for fish, birds, and mammals.

Despite the ecological benefits brought about by beavers, flooding caused by beaver dams may sometimes damage roads, houses and agricultural and timber lands. Although many anglers do not look favorably on beavers, studies indicate that beaver-created wetlands actually benefit trout populations.

HABITAT REQUIREMENTS

Beaver habitat includes low gradient streams and rivers, as well as ponds and small lakes with consistent water levels. Beavers prefer streams that are wider than 150 feet with a gradient less than 6 percent.

Most people are familiar with the beaver's industrious efforts to fell trees within their habitats. The beaver's food requirements vary seasonally. During the summer months, beavers rely almost exclusively on herbaceous foods such as duck weed, duck potato, and water lilies as well as leaves and grasses. Tree cutting and consumption of woody material generally occurs in the fall and winter; beavers favor hardwood tree species such as aspen, willow, and alder. They prefer stems under 4 inches in diameter and within 100 feet of water's edge, but readily fell larger trees and trees up to 300 feet from water. The beaver colony will cache enough woody material to support them throughout the winter months if the surrounding habitat is suitable.

Beaver activity centers around the lodge. Lodges and burrows (or bank dens) surrounded by water provide escape, thermal, and reproductive cover for beavers. Water serves as concealment and easy access for beavers when traveling to and from food sources.

Although they generally stay within 300 feet of water, beavers may range within a .5-mile radius of their lodge. Beaver colony territories do not overlap and usually contain a series of lodges, dams, and ponds of various ages and sizes along a stream's drainage.

MANAGEMENT PRACTICES

A site with an adequate water supply and stream gradient of less than 15 percent will probably support beavers if enough small diameter hardwood trees are within 300 feet of the water's edge. Where only large-diameter trees of preferred species are present, you can enhance beaver habitat by cutting .5 to 1-acre patches perpendicular to the water's edge. These cuts should be pie-shaped and on shallow slopes to minimize the potential for erosion and impacts to the wetland buffer. The cuts should

Figure 24.3 Beaver baffle control system

extend no more than 300 feet from the water and should range from 50 to 120 feet wide. Depending on the size of the water body and the availability of hardwood trees, one strip should be cut every 10 to 20 years to ensure a continuous supply of small diameter woody material. Cutting during the dormant season (November through March) will promote tree sprouting and increase regeneration.

Because beaver ponds are most productive for the 7 years immediately following flooding, abandoning an area for a period of time is often beneficial. Once habitat conditions again become favorable, beavers will return.

If you are experiencing problems with beaver, there are options that can help. In well-established beaver habitats, most conflicts cannot be permanently resolved with the removal of the beavers (they or others will return). You can protect individual trees from beaver damage if you encircle their trunks with hardware cloth or welded wire. In addition, several designs of water control structures are available which may solve flooding problems. Not all sites lend themselves to water control structures.

Regulated trapping is also an effective strategy for managing beaver in wetlands. The removal of beaver during the legal trapping season is a method that ensures utilization of the pelt. Live trapping and transfer of beaver is no longer recommended in Vermont because most appropriate habitat is already occupied. See **Resources** for a link to more options.

If you are experiencing problems with beaver, there are options that can help.

RESOURCES

Vermont Fish and Wildlife Department. "Managing Problem Beaver." http://www.vtfishandwildlife.com/library/reports_and_documents/Furbearer/Best_Management_Practices_for_Human-Beaver_Conflicts.pdf

➤ PAGE 103

25. WATERFOWL

Wetlands are the critical habitat required for waterfowl because they provide areas to rest, strengthen pair bonds, feed, and establish nesting territories.

SUMMARY

Waterfowl are intimately connected with wetland habitat; they perish or thrive based on the availability of wetlands. Landowners can best promote waterfowl by maintaining and protecting wetlands and by maintaining a forested or grassy buffer around open water. Maintain wetlands with a mixture of plants and open water, and avoid the use of herbicides or pesticides near wetlands or other water systems. Monitor wetlands annually for invasive plant species, particularly knapweed and purple loosestrife, and pull those plants up to help promote the growth of native plants. Leave dead snags or large live trees up near wetlands as nesting sites for cavity nesting ducks, or consider erecting a wooden nest box.

NATURAL HISTORY

Due to the diversity of waterfowl species and their migratory nature, management of our waterfowl resource must be shared among various countries, states, provinces, private organizations, and individuals. Vermont hosts 30 species of waterfowl during various seasons. As with all wildlife, food, water, and cover are essential seasonal needs of waterfowl. Although the protection and management of essential habitats such as Lake Champlain, riverine systems, and large wetlands are primarily within state and federal responsibility, much of the habitat needed by waterfowl in Vermont involves small privately owned wetlands. You can assist in waterfowl management efforts by supporting state and federal programs to restore quality habitat, or by directly implementing proven waterfowl management practices on wetlands in your ownership. With an increasing human population and on-going loss of habitat, wetland protection and enhancement on private land is one of the most critical wildlife habitat conservation actions.

HABITAT REQUIREMENTS

Waterfowl usually breed and rear their young in northerly latitudes and spend the winter months in more southern climates. During these semi-annual migrations, birds utilize a variety of habitat types to feed, rest, preen, and escape from predators. Waterfowl may nest on the ground,

in cavities, on stumps, or in tree crotches, and lay clutches of 9 to 16 eggs. Predation pressure on nests and the flightless young is generally proportional to the quantity and quality of the habitat. Larger clutch size and the ability to re-nest help waterfowl to offset losses from predators.

Waterfowl feed on everything from insects and small invertebrates found in shallow wetlands, to snails, mussels, and small fish in deeper water. Aquatic vegetation and seeds in shallow- and deep-water wetlands comprise a major portion of the diet for many species. Agricultural field crops and grain have become important food sources, especially for geese, during migration.

Black ducks, mallards, wood ducks, blue-winged teal, hooded mergansers, common goldeneyes, and Canada geese are Vermont's principal breeding waterfowl, and benefit most from habitat management. Improvements in habitat aimed at these species will generally also benefit other migrating waterfowl species.

Canada geese are short distant migrants that arrive back in Vermont in mid-March and remain into late fall; they are present as long as open water and a food source is available. The resident population of Canada geese generally only migrates as far south as New Jersey and they can sometimes become a nuisance problem in urban and agricultural landscapes. True migratory Canada geese (Atlantic population), migrate from the northern Québec tundra nesting grounds to the Chesapeake Bay region and are managed as a separate population.

Wetlands are the critical habitat required for waterfowl because they provide areas to rest, strengthen pair bonds, feed, and establish nesting territories. The Champlain Valley and Connecticut River Valley are the main flight corridors for waterfowl migrating through Vermont.

Wetland productivity is a measure of how well the needs of wetland species are met. For waterfowl, this translates into the quality and quantity of available water, food, cover, and nesting sites. Pollutants and disturbance are important factors when assessing wetland productivity. Most Vermont wetlands have excellent productivity and are worthy of continued protection and enhancement. A variety of wetlands and adjacent uplands are needed to fulfill seasonal requirements of waterfowl. A complex of different wetland types is desirable to provide a diversity of foods and cover for a variety of waterfowl species.

Small wetland units are best managed in their natural condition. Improving specific deficiencies in open water to cover ratios, nesting and brood-rearing habitat, or enhancement of wetland soil productivity may be beneficial in certain situations as explained in the next section.

MANAGEMENT PRACTICES

The rich and diversified system of wetlands present in Vermont was left in place by the last glacier. Waterfowl have used these wetlands for thousands of years. Most natural wetlands need little, if any, human manipulation. Rather, wetlands need protection from human manipulation such as draining, filling, livestock grazing, shoreline development, excessive sedimentation, and harmful chemicals.

The most important management practice you can implement to benefit wetland habitat is to buffer them with at least 100 feet of grassland or forested cover. Minimize disturbances from natural predators, pets,

and people, especially during nesting and brood rearing from April to July. Disturbances can cause waterfowl to abandon breeding attempts or established nests. When you observe waterfowl, do so quietly from a distance with binoculars or spotting scopes.

Figure 25.1
Wood duck in nesting box.

Figure 25.2
A common type of nest box for wood ducks.

Wetlands are dynamic systems and continually undergo changes in appearance, productivity, and wildlife value. The sequence of wetland succession occurs as shallow water areas fill in and become vegetated marshes, then shrub swamps, and finally forested areas. Although all phases are important to individual species of wildlife, waterfowl derive optimal habitat value from intermediate wetland stages.

Areas of emergent plant cover, shrub vegetation, or fallen timber should be interspersed with swimmable water to provide optimal habitat. Cut or pull undesirable cover species but do not use herbicides to kill native aquatic plants because this is generally prohibited by the Vermont Department of Environmental Conservation and Agency of Agriculture.

Waterfowl generally prefer shallow depths of 1 to 2 feet of water, although periodic cycles of high and low water increase productivity over time because soil nutrients are renewed and the soil and organic material is exposed to the air. Seasonal water cycles or beaver activity regulate this naturally, however, you may construct artificial water level control structures where you need more intensive water level management.

Waterfowl food and cover plants are usually well established on older wetlands and will appear in a reasonably short time on new impoundments without a helping hand. Seeds from aquatic plants adapted for this climate are dispersed naturally so it is usually unnecessary to supplement native food and cover species with artificial plantings. However you should monitor annually for noxious weeds (exotics) such as phragmites, water chestnut, and purple loosestrife and eradicate them because they have little value for waterfowl and quickly crowd out desirable native aquatic plants. Exotic wildlife such as mute swans and carp can also damage wetland systems. Swans should be reported immediately to your local Vermont Fish and Wildlife Department office.

Although adequate nesting cover should be near a wetland, waterfowl may nest up to a half-mile from brood-rearing habitat. Ducks may nest on the ground near wetlands in areas with dense vegetative cover, near beaver ponds in over-water tree stumps or tree crotches, or on small islands with good cover. You can help by delaying when you mow hayfields in close proximity to wetlands until after July 15 or preferably August 1 to decrease nest destruction by mowing equipment. Avoid grazing on lands adjoining wetlands prior to July 15 and stop grazing in late August to allow for adequate regrowth of nesting cover for the next spring. Rotate grazing areas to ensure adequate nesting cover, and use perimeter fencing to avoid livestock damage to wetlands. For technical and financial assistance with the design of a rotational grazing system, see your local Natural Resources Conservation Service office. Contact information follows in **Resources**.

Wood ducks, hooded and common mergansers, and common goldeneyes are cavity nesters; they prefer live trees such as maple and oaks, although they may use dead snags. These species also benefit from nest boxes on trees or sturdy poles near the wetland. These nest boxes must be built to specific dimensions, filled with wood shavings, and cleaned and maintained annually, and they must have a predator guard to protect the hen and nest. Specifications and technical advice on nest box construction and placement are available through the Vermont Fish and Wildlife Department.

The increase in beaver populations in Vermont has led to the creation and maintenance of excellent natural waterfowl habitat. Management of beaver colonies provides a great opportunity to assist waterfowl (see **Chapter 24, "Beavers"**). Consider the use of a beaver baffle to control water levels before eradicating beaver. Vermont's regulated trapping season for beaver provides a good opportunity to combine the sustainable use of a renewable natural resource (beaver) with effective wetland management.

Canada geese are grazers and will readily clip grasses and legumes planted in buffer strips and agricultural fields. If you wish to discourage geese from feeding on your lawn or agricultural field, allow shrubs and trees to grow along the wetland border. Shrubs and brush obscure the grass areas and trigger the geese's predator avoidance behavior.

To attract waterfowl to your cropland areas you can leave standing grains to provide food plots. Grains must be left standing or harvested under normal agricultural practices to avoid the practice of baiting waterfowl during the hunting seasons. Never mow standing grains during the hunting seasons. Contact the Vermont Fish and Wildlife Department for clarification of acceptable practices. Avoid fall tillage whenever possible to allow utilization of waste grain during both the fall and spring but do not place piles of supplemental feed out because of the potential to spread disease and problems with concentrated droppings on lawns and waters.

If you are interested in wetland restoration, consult the Partners for Wildlife Program. Sponsored by the U. S. Fish and Wildlife Service, this program is tailored to restoring previously converted wetlands into functioning wetlands with financial support to qualified landowners. The Natural Resources Conservation Service and Vermont's Clean and Clear programs have technical and financial assistance available to landowners interested in wetlands restoration and or protective easements on wetland parcels.

To attract waterfowl to your cropland areas you can leave standing grains to provide food plots.

RESOURCES

U. S. Department of Agriculture. Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

Vermont Fish and Wildlife Department. "Factsheet on wood duck nest boxes and predator shields."

U. S. Fish and Wildlife Service Northeast Region. Partners for Wildlife Program. http://www.fws.gov/northeast/EcologicalServices/partners.html

26. RUFFED GROUSE

Bonasa umbellus

This upland game bird is best known for its explosive flushes when approached too closely and for the reverberating drumming sound males produce to attract mates in the spring.

SUMMARY

Ruffed grouse, or partridge, are found throughout Vermont, and are targeted by hunters and other carnivorous birds and mammals. They thrive in dense, younger forests with a mix of shrubs, softwood, and young hardwood trees. Ruffed grouse feed primarily on fruits, berries, and nuts such as beechnuts and acorns. They require small openings of bare ground and fallen logs or rock walls for breeding. Maintaining a mosaic of dense softwoods, mast-producing hardwoods, and fruit and berry trees will help landowners promote ruffed grouse.

NATURAL HISTORY

Ruffed grouse, commonly known as "partridge," are one of Vermont's two members of the grouse family (spruce grouse being the other). Ruffed grouse can be found in every region in the state. This upland game bird is best known for its explosive flushes when approached too closely and for the reverberating drumming sound males produce to attract mates in the spring.

Annual mortality rates for ruffed grouse are quite high, approaching 70 percent. Grouse serve an important ecological role as a significant prey base for a host of ground predators such as foxes, raccoons, coyotes, skunks, bobcats, and avian predators such as goshawks, Cooper's hawks, and great horned owls. In the northern latitudes of Vermont, winter's cold temperatures and lack of food can result in poor survival as well. Deep snows, however, may actually enhance grouse survival by enabling them to dive below the snow's surface to the security and insulation of a "snow roost." The birds thrive best in the cover of dense young forests (especially aspen) and produce prolific numbers of young.

The polygamous male grouse interact with females only during the spring breeding season. The males select drumming sites on logs or rock walls above ground level that are surrounded by dense vegetative cover. They beat their wings rapidly to create a low-frequency drumming noise that penetrates the forest and attracts resident female grouse. Females incubate their eggs in a well-camouflaged nest at the base of a tree, and chicks hatch in late May and early June.

Figure 26.1
Grouse drumming

➤ PAGE 108

Grouse eat a wide variety of foods, primarily grasses and insects, during spring and summer. Other favorite foods include the leaves, fruits, and seeds of aspen, blackberries, raspberries, elderberries, clover, and wintergreen. In fall, beechnuts and acorns are primary sources of energy-rich fat. When these fruits are no longer available, grouse feed on the buds and catkins of mature aspen, birches, hophornbeam, and hazel.

HABITAT REQUIREMENTS

Habitat consisting of several age classes of early successional tree species, such as aspen and paper birch, is most preferred by ruffed grouse. Superior grouse habitat contains three "critical" age classes of forest (0–10, 10–25, 25+ years), all located within a 40-acre home range. Quality grouse habitat also includes seasonal food sources close to thick, woody cover. Patches of softwood cover provide thermal protection during Vermont's stressful winter season.

Figure 26.2
Young forest grouse habitat

Ruffed grouse require cover for breeding, nesting, brooding, and winter roosting. Breeding cover consists of 10- to 25-year-old hardwood stands that contain a few scattered logs (at least 8 inches in diameter) elevated off the ground, large stones, or rock walls to be used as drumming sites. The best drumming sites provide adequate overhead cover from adjacent tree crowns or overhanging branches to protect from avian predation, as well as providing dense horizontal cover surrounding the drumming site. Horizontal cover is provided by thickets of young saplings, brush and/or logging slash that reduces visibility and provides some security cover to vulnerable drumming males from ground predators.

Nest sites are often found in open hardwood stands at the bases of trees or in cutover areas just under the edge of slash piles. These sites offer protection from at least one direction, reducing nest vulnerability.

Brood cover is typically found in brushy areas or seedling/sapling stands. Lowland areas with a mixture of young hardwoods or alders provide excellent brooding habitat. The edges of openings also offer excellent brood habitat. These areas have abundant herbaceous vegetation and high insect populations. Both conditions are important to meet the high-energy demands of young birds.

In the winter when powder snow depths are sufficient, grouse prefer to use snow roosts, as they provide the most thermally favorable protection from severe weather. In the absence of suitable snow cover or in crusted snow conditions, winter roosting habitat is also provided by deciduous saplings, or softwoods that provide some thermal cover from wind and cold temperatures.

Figure 26.3
Aspen bud

MANAGEMENT PRACTICES

Aspen is widely recognized as a key tree species in ruffed grouse management. Buds of mature male aspen trees serve as a preferred winter food source, and young stands of aspen provide necessary dense cover. As such, you should give aspen stands, which sprout prolifically when cut, priority over other timber types when managing for grouse habitat. Stands with only a minor component of aspen can usually convert to predominately aspen if clearcut during dormancy (in the fall once leaves are off the trees).

Maintenance of dense, young forests should be your highest priority in grouse habitat management. Once you have identified an area to be managed for grouse (preferably one that includes some component of aspen), divide the area into stands of 2 to 5 acres. Every 10 years, rotate treatment on one-quarter of the stands as described below in a checkerboard pattern. Stands with the oldest aspen trees should be treated first.

Within each stand of roughly 5 acres:

1. **Prune apple and other fruit-producing trees and shrubs** such as hawthorn, cherries, dogwoods, nannyberry, and sumac and release them by cutting adjacent trees that are competing with and crowding them. Successful release of such species will allow them to be free to grow with no overtopping vegetation. The main crown area of the trees to be released should not have competition within the drip line and preferably beyond.
2. **Retain small patches of softwood trees** (1/4 to 1/2 acre in size) for winter cover. Preferred species include eastern hemlock, northern white cedar, or areas of spruce-fir, but any softwood that intercepts snow and wind thereby decreasing snow depths and wind chill is beneficial.
3. **Maintain rock walls free of vegetation** and/or leave several large, elevated logs as drumming sites during the stand treatment.
4. **Provide openings with herbaceous vegetation** on 10 percent of the area being managed (4 acres of a 40-acre management area). Create herbaceous acreage by seeding log landings and woods roads. Maintain by periodic mowing.
5. **Maintain mast trees** as sources of fall foods such as oaks, hophornbeam, or beech as long as they do not total more than 20 percent of the area. Be mindful however that a "key mast area" such as a high-value oak or beech stand is not an appropriate site to clearcut for grouse. Look for an alternative, more appropriate area to manage for this type of early successional stage, grouse management.
6. **Clearcut the remainder of each stand** being treated during the winter dormant season to promote prolific aspen sprouting in the newly created open sunlight. Keep in mind that just because an area is clearcut, it is not guaranteed that aspen will regenerate. In order to assure a higher likelihood of regenerating aspen, there should be vigorous aspen already in the stand to be clearcut.

If your woodlot has not been managed before and consists of older aspen trees (more than 40 years of age), the management activities need to be accelerated. Treat half of the stands of 5 acres or less as prescribed above and follow with a second treatment of the remaining half of the area in 10 years. Throughout the process, maintain groups of mature aspen on the property for winter food supplies.

27. AMERICAN WOODCOCK

Scolopax minor

SUMMARY

American woodcock are an important game species that spend the breeding season in Vermont. They require moist areas of dense alder, dogwood, and willow for nesting and roosting, and open grassy areas for their spring courtship rituals. To manage for this species, you should maintain young alder, dogwood, and willow thickets, and regularly mow and clear adjacent areas to keep them open and grassy.

NATURAL HISTORY

The American woodcock is an important game species in Vermont and throughout the northeastern United States. Woodcock are members of the shorebird family which include dowitchers, yellowlegs, and snipe. With their distinctive, long flexible bills, woodcock spend much of their day satisfying their voracious appetite by probing the moist soils of alder and dogwood swales and other moist depressions for earthworms and other soil invertebrates.

Woodcock are a migratory species. They are distributed throughout eastern North America during the breeding season and the summer, but retreat to the southeastern U. S. (principally Louisiana and east Texas) to spend the winter. Woodcock arrive in Vermont as early as March. Males usually arrive first to establish their territories. Male woodcock seek abandoned fields and forest openings to perform their elaborate courtship flights with alternating nasally "peents" or songs while they are on the ground. These areas are commonly referred to as singing grounds.

Woodcock usually nest, rear young, roost, and feed on moist soils near their breeding grounds. Chicks hatch in late May and early June; they are well developed at birth and mature rapidly. The chicks remain with their mother for about one month until they are capable of flight. The males do not take part in any brood rearing activities.

When autumn weather is cold enough to freeze the soil, making it impossible to probe for food, the birds begin the annual trek to their wintering grounds. In Vermont, this journey occurs between mid-October and early November.

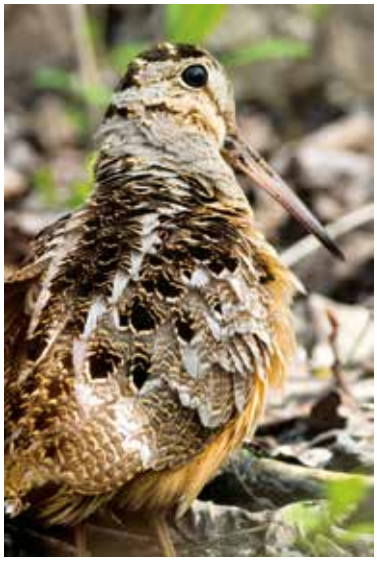
Figure 27.1
Woodcock courtship habitat

HABITAT REQUIREMENTS

Woodcock make use of two distinct types of cover. The first are swales commonly composed of alder, dogwood, and willow in which they feed, nest, and rear their young. They also use recently abandoned fields or forest openings to roost and perform their courtship flights. Woodcock do not need large tracts of land; an area of 25 acres can suit their needs and can be managed effectively.

Woodcock do not need large tracts of land; an area of 25 acres can suit their needs and can be managed effectively.

Figure 27.2
Alder swale make excellent woodcock cover habitat.



Woodcock seek out wooded and shrubby areas for protection from avian predators, but that also have a good line of sight at ground level to easily spot ground-dwelling predators. Typically these are stands of speckled alder and gray dogwood.

Singing grounds used for courtship displays are typically surrounded by shrub species such as blueberry, goldenrod, and red osier dogwood.

The woodcock's diet is composed primarily of earthworms and other invertebrates found in rich, moist loam and sandy loam soils found along borders of water bodies, the flood plains of most water courses, and the edges of beaver flowages. Other important foods include the larvae of flies and ground beetles. Studies have shown that a single woodcock can eat up to 90 percent of its body weight in a 24-hour period. Habitat management efforts should focus on maintaining and enhancing the feeding areas.

HABITAT MANAGEMENT

The woodcock's home range is relatively small, so as an individual landowner, you can have a very positive impact on local woodcock habitat. Alder and dogwood, the tree species which provide optimal cover, lose much of their value for woodcock after 20 years of age. To renew this cover, 25 percent of the feeding area should be clearcut in patterns of narrow strips (10 to 20 feet) or in small patches (1/4 acre) every 5 years.

Maintain open areas in a grassy or herbaceous condition near feeding areas for roosting and the performance of courtship rituals. They are best maintained by mowing or brush hogging every 3 to 5 years. Controlled burning and pasturing may also be effective, but do not provide the same degree of control over undesirable vegetation that mowing does. Small forest openings can be created and maintained if they do not already exist, but abandoned fields are preferred by the birds.

RESOURCES

U.S.D.A. Natural Resources Conservation Service. "Wildlife Habitat Insight 89 - American Woodcock: Habitat Best Management Practices for the Northeast." http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=28815.wba

28. WILD TURKEY

Meleagris gallopavo silvestris

SUMMARY

Wild turkeys were reintroduced to Vermont starting in 1969 and are now abundant throughout the state. They are omnivorous birds, feeding on grasses, leaves, grains, insects, nuts, and berries. They thrive on a matrix of forest and fields, particularly with intact hardwood forests with mast-producing trees such as beech and oak. To manage your land for turkeys, you should maintain these hardwood forests in addition to promoting agricultural fields, open grassy areas for breeding, and small, dense softwood for winter roost sites. Promoting fruit- or berry-producing trees and shrubs also attracts turkeys.

NATURAL HISTORY

Vermont's wild turkey is a forest game bird closely associated with mature hardwood stands of mast-producing trees such as beech and oak. These stands were largely eliminated from the state in the late 1800s due to heavy logging, and agricultural expansion resulted in the disappearance of the wild turkey from the state. After the regeneration of Vermont's hardwood forests in the twentieth century, suitable turkey habitat was created and 31 turkeys were relocated from New York to Vermont in 1969 and 1970. There are now an estimated 50,000 turkeys found throughout Vermont, exceeding the bird's ancestral range in the state.

The reproductive cycle for the wild turkey begins in April when the males can be found gobbling and strutting to attract hens. Turkeys are polygamous, and most of the breeding is done by a relatively few dominant gobblers. Turkey chicks usually hatch in late May at which time herbaceous clearings and pastures are used intensively by the hen and her brood in search of the protein-rich insect food necessary for rapid growth. During this stage of development, the poults are quite vulnerable to cold, wet spring weather as well as to predation.

To manage your land for turkeys, you should maintain these hardwood forests in addition to promoting agricultural fields, open grassy areas for breeding, and small, dense softwood for winter roost sites.

Figure 28.1
Turkeys were successfully reintroduced into Vermont more than 40 years ago.

Turkeys are social birds and their flocking instinct is very strong. Hens and their poults flock in groups of 30 or more with a small flock of attending gobblers from summer through the winter months until breeding season, when courtship and mating rituals resume. Turkeys travel mainly on foot with occasional short flights if alarmed. At dusk, the birds fly up into mature trees to roost, which protects them from ground predators during the night.

The initial insect diet of the young poults is gradually replaced by feeding on grasses and grains, ripening fruit and nut crops of midsummer and fall. In winter, the birds scratch through the accumulating snow for foods such as nuts and seeds. Their search for food becomes very difficult in snow depths over one foot. During these stressful periods, turkeys seek warmer south-facing slopes with less snow and snow-free areas around spring seeps where water continually percolates from the ground.

HABITAT REQUIREMENTS

The wild turkey is a highly mobile species, capable of exploiting a wide range of forest types. In optimum habitat, turkeys may restrict themselves to less than 1,000 acres, depending upon season, food supplies, and cover. In poorer habitats, the birds may fly from one ridge to another, exceeding 4,000 acres in home range.

Good turkey habitat contains a diversity of forest types and age classes, dominated by mast-producing hardwoods, such as oak and beech, which are relatively open under the canopy. Quality habitat includes clearings and openings, groups of conifers, and cultivated land well-interspersed within the forest matrix. Edge openings and forest roads are used in the spring breeding season for courtship activities and strutting displays.

The sites selected by females for their nests vary greatly. The nest itself is a slight depression in the forest litter, usually well concealed by dense vegetation. Thickets, brush piles, fallen trees, and the bases of standing trees between root flares are often used as nest sites.

Brooding habitat is found in sunlit openings, grassy clearings, meadows or "savannah-like" areas such as a pure stand of hophornbeam with a grassy understory, which is used intensively by the hen and her chicks to search for insects. Adult turkeys are primarily herbivorous ground feeders. In the spring, mature birds occasionally eat insects but favor succulent grasses, sedges, tubers, and blossoms. Their summer diet includes ripening fruits and the seeds of grasses and clovers. Acorns, beech, and hickory nuts are utilized most in the fall and winter, making up a significant portion of the bird's diet when available. In northern Vermont, where oaks are lacking, mature stands of seed-bearing trees including maple and ash supplement beechnuts, and soft mast such as apples, cherries, and hawthorn fruits are very valuable foods.

In winter, when snow conditions make foraging difficult, spring seeps are sought where turkeys can glean insects and herbaceous vegetation. In winter, turkeys forage on fruits that persist above the snow such as hophornbeam, burdock ash seeds, red cedar berries, grapes, highbush cranberries, beech and hemlock buds, and waste grains from spread manure and corn silage.

Turkeys roost in large diameter trees with strong, horizontal branches and prefer white pine and hemlock in winter for cover from wind and cold temperatures.

MANAGEMENT PRACTICES

Ideally, an area managed for turkeys is about half-forested and half-open lands. Manage the woodland portion to result in mature forest composed primarily of masting hardwood species, particularly oak and beech, with roughly a quarter consisting of conifers such as hemlock and pine. Small, interspersed clearcuts, pastures, and cultivated land in the balance of the managed area will provide the diversity needed to meet breeding, nesting, and brooding requirements. Maintain these openings through regular brush hogging or haying, and seed log landings, logging roads, and rights-of-way with a grass and legume mix.

Maintain a varied composition of food-producing species such as oak, beech, hickory, cherry, ash, and hophornbeam throughout the area to act as a buffer against the natural variability of mast production. During thinnings, favor mast producers and encourage understory species that provide fruit or soft mast. Crop tree management techniques, commonly referred to as Mast Tree Release where there is a wildlife objective, can be used to increase mast production by releasing crowns of mast producers (e.g., oak) from crowns of competing trees. Culling these competing trees will make mast production better in both poor and good mast years. Studies have found that released oak trees may produce up to seven times more acorns than unreleased trees. Even in poor acorn years, released red oak has been found to produce twice the amount of acorns as unreleased trees. At a stand level this difference can be significant, particularly to wildlife experiencing a bad mast year.

One method to create additional brushy habitat is to cut back or heavily thin 50-foot borders around the edges of fields to stimulate brushy growth and provide nesting and feeding cover. This work should be accomplished on a periodic basis so that cutting does not occur all at one time. When reclaiming abandoned fields, pastures, or clearing brushy areas, avoid doing work during the nesting season (mid-April to August 1). For agricultural hayfields, mowing should preferably be delayed until August.

Spring seeps occur where warm ground water percolates to the ground surface and provides open, snow free areas during the winter months that are used by wildlife as feeding sites. In addition to their value as winter food sources for turkeys, spring seeps are also critically important habitats for a number of species of mammals, aquatic invertebrates, and amphibians and should therefore be protected from disturbance.

Maintaining wooded corridors and brushy fence rows, or establishing hedgerows across large fields (10 acres or more) provides valuable travel and escape cover for turkeys between woodlots. Establishing brushy “islands” of hardwoods, conifers, and shrubs can be favorable to help to break up large open areas. Native plantings can include apple species, hawthorn, elderberry, sumac, highbush cranberry, serviceberry, viburnums, cherries, and dogwoods. Turkeys should be allowed access to manure piles and spreadings during winter months. Rows of standing corn can also be left for winter use.

Small, interspersed clearcuts, pastures, and cultivated land in the balance of the managed area will provide the diversity needed to meet breeding, nesting, and brooding requirements.

RESOURCES

U.S.D.A. Natural Resources Conservation Service. “What is Forest Stand Improvement?”http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081110.pdf

—. “Mast Tree Release.” http://efotg.sc.egov.usda.gov/references/public/VT/JS666VT_(Mast)_FillableForm.pdf

PART EIGHT:
Habitat Management for Nongame Species

29. BATS

SUMMARY

Bats play an important role in Vermont's ecosystem, eating one-half of their weight in insect pests each hour. Many Vermont bat populations, already in decline from habitat loss, have been decimated over the last several years due to a fungus that causes white-nose syndrome. To help bats thrive on your land, leave dead snag trees standing, particularly trees with sloughing bark or cavities. Consider building a bat house for your property or allowing bats to enter any old barns or abandoned buildings on your land. Maintain forest connectivity among forest patches and wetlands, streams, and other bodies of water. If you think bats may be using a cave on your land as a hibernaculum, do not alter or block cave entrances or visit caves during the winter when bats are hibernating.

NATURAL HISTORY

Bats are one of the most diverse groups of mammals and play a significant role in keeping insect populations in balance with our ecosystems. Bats comprise one-fourth of the world's mammals. Of the nearly fifty species of bats found in the United States, nine occur within Vermont. All of Vermont's bats are insectivorous, meaning they eat insects, primarily beetles, moths, and smaller flying insects such as mosquitoes. Bats' importance in controlling both native and nonnative insect pests has been demonstrated in studies that document feeding rates of more than 1000 insects per hour!

Most of the world's bat species are declining in numbers and many are considered endangered, likely due to the negative effects of deforestation, contaminants, and persecution by humans. Five of Vermont's bat species are now officially designated as endangered, most of which have been severely decimated during the past five years by the spread of white-nose syndrome, a condition caused by an invasive fungus spreading to many bat caves.

Bats are long-lived mammals (i.e., 20 to 30 years) with low reproductive rates; most Vermont bats produce only one pup per year. For this reason, Vermont landowners can play an important role in providing both artificial and natural habitats to enhance survival and productivity of Vermont's bats.

Vermont's nine species of bats can be separated into two groups; the smaller "cave bats," which hibernate in caves and mines during the winter season and congregate in "maternity colonies" during the summer to give birth to young, and the larger "tree bats," which roost (i.e., spend the day) among tree foliage and migrate south for the winter (see **Table 29.1**).

At least 30 caves and mines in Vermont are known to serve as significant winter hibernacula for Vermont's six species of cave bats. Many of these caves have seen precipitous declines in bat numbers due to white-nose syndrome. In some instances, bats found in Vermont during the summer are known to hibernate in mines in New York. Bats travel to their hibernacula in late summer or early fall and "swarm" to breed near cave entrances for a month or more prior to hibernation.

To help bats thrive on your land, leave dead snag trees standing, particularly trees with sloughing bark or cavities.

Does this new photo need a cation and Figure ID?

Given the variety of habitats used by bats in Vermont, if your property has forestland, streams, or wetlands it likely provides suitable habitat for bats.

Table 29.1
Winter and summer roosting habitat of Vermont's bat species.

Species of Bat	Winter Habitat	Summer Roose Type
CAVE BATS		
Little brown bat (*Myotis lucifugus*)*	Cave/Mine	House, barn, bat house, dead or dying trees
Big brown bat (*Eptesicus fuscus*)	Cave/Mine, House attic or cellar	House, barn, bat house, dead or dying trees
Northern long-eared bat (*Myotis septentrionalis*)*	Cave/Mine	Dead or dying trees
Indiana bat (*Myotis sodalis*)*	Cave/Mine	Dead or dying trees
Small-footed bat (*Myotis leibii*)*	Cave/Mine	Rock ledges and cliffs, dams
Tri-colored bat (*Perimyotis subflavus*)*	Cave/Mine	Live and dead foliage
TREE BATS		
Red bat (*Lasiurus borealis*)	Migrates south	Live foliage
Hoary bat (*Lasiurus cinereus*)	Migrates south	Live foliage
Silver-haired bat (*Lasionycteris noctivagans*)	Migrates south	Dead or dying trees

* Threatened or Endangered

Upon emergence from caves in the spring (usually mid-April through May in Vermont), bats travel to their traditional summer range where the females set up maternity colonies in house attics, barns, large dead or dying trees, or even rock cliffs. Male bats may remain near hibernacula or travel to summer range where they remain solitary or in small bachelor groups. Bats are very sensitive to cool temperatures and need to roost with groups of other bats in places that receive solar radiation in order for their young to develop and survive.

In contrast, the tree bats migrate back to Vermont in the spring, often hanging among the foliage of large live trees that provide optimum cover and thermal conditions.

Given the variety of habitats used by bats in Vermont, if your property has forestland, streams, or wetlands it likely provides suitable habitat for bats. Recent research on Indiana bats indicates that this federally and state-endangered species establishes summer maternity colonies in the southern Champlain Valley of Vermont. If you live within this region, you are strongly encouraged to consider maintaining quality maternity roost trees and foraging habitat so that this species can be maintained and, preferably, recovered.

Figure 29.1
Bats hibernate in caves and mines that offer a constant temperature just above freezing.

HABITAT REQUIREMENTS

The keys to providing quality habitat for Vermont's bats are:

- Protecting caves and mines used by hibernating bats;
- Maintaining a mixture of suitable summer roosting sites such as roost trees, bat houses, and rock ledges;
- Maintaining a diversity of forested habitat conditions that includes a variety of stand structure; and
- Maintaining forest connectivity among roosting sites, foraging habitat, and aquatic features such as streams, rivers, and wetlands.

Vermont's cave bats must hibernate in caves and mines that offer a constant temperature just above freezing. These temperatures allow bats to maintain torpor to reduce energy consumption. Bats are extremely vulnerable to disturbance during this period, with each awakening costing the animals many days of critical energy reserves. Because bats are extremely concentrated during winter, they are vulnerable to disturbance by humans, predators such as raccoons, weasels, and domestic cats, and changes to the cave environment caused by human or natural alteration of the cave entrance or passages. Vermont bat hibernacula range in numbers of bats from as few as 30 to more than 25,000.

It is important for forestland surrounding hibernacula to provide suitable roost trees such as large snags in various stages of decay with loose bark, crevices, and cavities. These trees are particularly used in the fall and spring as the cave bats swarm or emerge, respectively.

As a general rule for Vermont's bats, lands providing a matrix of openings and interconnected forestland composed primarily of saw timber-sized or older stands provide the most suitable habitat for bats. Hardwoods generally provide better forest structure than softwoods for foraging habitat.

Access to sources of water is extremely important as bats do not store much water in their body due to the high-energy cost of flying. Open water also provides a concentrated source of insects. Forest connectivity and riparian corridors along streams, wetlands, vernal pools, and ponds are important in providing access to sources of water. Lastly, forest roads often serve as flight corridors that enable bats to quickly move between roosts and feeding sites.

You can create quality bat habitat by maintaining a mixture of forest age classes available in adequate supply, openings that provide forest edge habitat, and access to forested buffers along streams, wetlands, and water bodies.

Does this new photo need a cation and Figure ID?

HABITAT MANAGEMENT

In general, bat habitat management is very compatible with most forest management activities, provided there is an adequate supply of current and future roost trees. You can create quality bat habitat by maintaining a mixture of forest age classes available in adequate supply, openings that provide forest edge habitat, and access to forested buffers along streams, wetlands, and water bodies.

Landowners within the southern Champlain Valley of Vermont should pay particular attention to the likelihood that their forestland serves as habitat for a summer maternity colony of federally and state-endangered Indiana bats. More detailed forest management guidelines are available from the Vermont Fish and Wildlife Department when considering this species. (See **Resources** for contact and other information.)

Summer Range Habitat

Summer habitat comprises two components: *maternity roosting sites* where young are born and raised, and *foraging habitats* that provide a plentiful supply of insects upon which to feed.

Maternity Colonies in Trees. Bats species across the state use dead and dying trees to roost during the day and raise their young before they are able to fly. To provide this habitat you can do the following:

- Maintain and establish five to seven large roost trees of various stages of decay and size classes per acre. Roost trees should be represented within each of three size classes (less than 10-inches diameter at breast height (DBH), 10- to 18-inches DBH, and greater than 18-inches DBH). These trees should either be live shagbark hickories or dead or dying trees showing signs of cracks, crevices, loose bark, or cavities. These trees should be dominant or co-dominant in the forest stand.
- Enhance the value of roost trees by increasing solar radiation by removing some or all of the adjacent trees. Roost trees should not be isolated, however, from forest cover.
- Limit the dense vegetation directly at cave or mine entrances in order to provide space for swarming activity.
- Where an inadequate supply of dead or dying trees exist, large cull hardwood trees should be girdled to allow for decay to create a roost tree for the coming 3 to 5 years.
- Enhance existing and potential roost trees through selection harvesting or small group selection that opens up the canopy and improves solar exposure of the roost tree. Roost trees should not be isolated from forest cover.
- Maintain or recruit a supply of large-crowned live hardwood trees for tree bat roost sites. These trees should be dominant or co-dominant in the forest stand with an open understory beneath. Trees along forest edges or riparian areas are also most likely to be used by tree bats.

Maternity Colonies in Building and Barns. Landowners with bat colonies in their buildings or barns are encouraged to contact the Vermont Fish and Wildlife Department for information how to exclude bats from buildings. Bats should not be killed and entrances in buildings should not be sealed until the young are able to fly. (For more information, refer to the Vermont Fish and Wildlife Department pamphlet "Bats in Your House" at the link in **Resources**.)

Maternity Colonies in Bat Houses. Bat houses are valuable structures to establish or enhance maternity colonies of little brown and big brown bats. In Vermont, you should paint bat houses black and place them in a

location that will receive at least 8 hours of direct sunlight. Bat houses may be placed near dwellings, but can also be located on poles near aquatic features such as rivers, streams, and wetlands. (For more information on attracting bats, refer to **Resources**.)

Maternity Colonies in Rock Cliffs and Ledges. All rock cliffs and ledges receiving any solar exposure are potential roosting sites for the state threatened small-footed bat. Where these habitats exist on the parcel or within 2 to 3 miles maintain them with contiguous forest cover in saw timber or older stands and with forest connectivity to aquatic features such as streams, rivers, and wetlands.

Foraging Habitat

In general, both even-aged and uneven-aged forest management are compatible with suitable foraging habitat for bats. Foraging habitat is best provided through maintaining forest patches and connectivity to roosting sites and aquatic features.

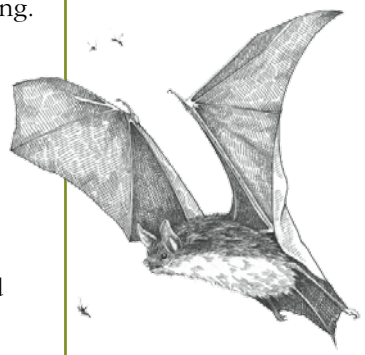
You can provide optimum bat foraging habitat through the following land management activities:

- Maintain a matrix of forestland (primarily comprised of saw timber-sized and older forest stands), openings that provide for forest edge, and forest connectivity to sources of water.
- Favor hardwood stands for establishing or enhancing bat foraging habitat.
- Thin forest stands to enhance the site for bat flight and make small group selections to create gaps in forest cover that provide edge habitat.
- Create openings in young stands to develop edge habitat.
- Maintain or establish forest roads as flight corridors between quality roost trees and older forest stands and sources of water.
- Maintain forested buffers along sources of water (e.g., streams, rivers, and wetlands), including forest cover near ponds. Forested buffers large enough to provide instream structure from fallen trees enhance bat habitat by creating slow moving pools of water for drinking and feeding.
- Maintain forest cover surrounding vernal pools.
- Maintain or expand hedgerows between forest patches and aquatic features.

Winter Hibernacula

If you have a cave or mine on your property, you should contact the Vermont Fish and Wildlife Department to determine if the site serves as a hibernaculum for bats. If so, you should make plans to maintain the cave/mine and minimize human disturbance of the site during the period from September 1 through May 31. Landowners with property within a 5-mile radius of a bat hibernaculum are more likely to have resident bat populations, particularly during the spring and fall. By following the guidelines above for maternity colonies in trees, you will satisfy the roost tree requirements for bats as they congregate around caves/mines during the fall and spring.

Bat houses are valuable structures to establish or enhance maternity colonies of little brown and big brown bats.



RESOURCES

Vermont Fish and Wildlife Department. "Attracting Vermont's Bats." http://www.vtfishandwildlife.com/library/factsheets/nongame_and_Natural_Heritage/Attracting_Vermont's_Bats.pdf

—. "Bats in Your House." http://www.vtfishandwildlife.com/library/factsheets/nongame_and_Natural_Heritage/Attracting_Vermont's_Bats.pdf

30. REPTILES AND AMPHIBIANS

Most reptiles and amphibians, or "herps" as they are commonly referred to, require water for some stages of their life.

SUMMARY

Reptiles and amphibians represent an interesting group of species in Vermont and play an important role in the overall ecology of the landscape. Many species of reptiles and amphibians perform tasks that benefit people, such as insect and rodent pest control. Most reptiles and amphibians, or "herps" as they are commonly referred to, require water for some stages of their life. To manage your land for reptiles and amphibians, conservation of streams, ponds, wetlands, and vernal pools is essential for these animals' survival. Other habitat features that benefit herps include intact forest buffers along water, rock walls, brush piles, downed trees, and hollowed stumps. On stream banks with low levels of erosion, maintain sandy areas for turtle nesting. For more information, check out the *Vermont Reptile and Amphibian Atlas* referenced in **Resources**.

NATURAL HISTORY

Vermont has a rich diversity of salamanders, frogs, snakes, and turtles living in the state. With 40 different species, we should be mindful of the vital role these often over-looked species play in our ecosystems.

Reptiles and amphibians are beneficial to Vermonters. Salamanders, frogs, toads, lizards, and some snakes can consume large quantities of harmful insects. The larger snakes eat mice, rats, and other rodents. Some turtles act as scavengers in lakes and ponds, and others prey on snails, which act as intermediate hosts for parasites. In addition, reptiles and amphibians provide an important food source for other animals, including fish and birds. These creatures are interesting to observe and study and most species carry out their ecological roles without conflict with people.

Amphibians and reptiles are vertebrates, much like birds and mammals. However, unlike mammals and birds, herps are "cold-blooded," meaning that they do not produce their own body heat but instead absorb heat from their environment. Because body heat comes from external sources rather than from their own metabolism, herps do not need to feed on a regular basis and can be inactive for extended periods of time. For example, some large snakes require only one large meal per year. Terrestrial salamanders feed primarily during several warm, wet nights within their active seasons. Most herps are inactive during cold seasons. Without the protection of fur or feathers, temperature and moisture dictate when and where amphibians and reptiles are active.



Figure 30.1 a,b,c
(l-r) Vernal pool; Spotted salamander; Spring peeper

HABITAT REQUIREMENTS

Amphibians and most reptiles require water for some part of the year. Turtles usually inhabit permanent water resources such as lakes, ponds, or slow-moving sections of rivers. Aquatic snakes spend much of their lives in and near the shallow edges of lakes and streams. Frogs, toads, and most salamanders lay their eggs in water and spend the early part of their lives as gill-breathing larvae or tadpoles. Many breed in temporary ponds such as vernal pools and other shallow wetlands free of fish. Some frogs remain in or near lakes and ponds, but others disperse into surrounding areas. Northern leopard frogs, for example, prefer damp meadows with permanent ponds, but gray treefrogs, wood frogs, spring peepers, and many salamanders inhabit shady wet woodlands with temporary seasonal ponds. (Refer to **Chapter 12, "Wetland Habitats Management"** for more information on vernal pools.)

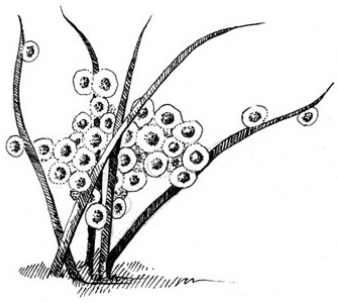
Management Practices for Frogs, Toads, and Salamanders

Although more than 3,400 species of frogs and toads occur worldwide, only 11 of these species live in Vermont. Of these 11 species only one, boreal chorus frog is listed as endangered, while the Fowler's toad is considered a species of special concern. Vermont is also home to ten species of salamanders, including the eastern newt, Jefferson salamander, blue-Spotted salamander, four-toed salamander, and mudpuppy, a species of special concern in the state.

Water is critical to the survival of most frogs, toads, and salamanders, because they seek shallow wetlands and vernal pools in which to breed and lay eggs. When the shallow wetlands/vernal pools remain wet and free of egg and larvae-eating fish, young, gill-breathing amphibians, will make the transition from egg to larvae to adult in one summer. Dry years can result in few eggs and/or hatchings. Species that do not require large wet areas may lay their eggs in ditches with just enough water to encourage breeding.

Some frogs and salamanders lay their eggs attached to submerged sticks and vegetation. Others like the bullfrog and green frog lay their eggs in a large film that floats on the surface. Mudpuppies look under rocks and logs in warm shallow water for their nest chambers, and the four-toed salamander lays its eggs under sphagnum moss near the edges of wetlands.

Salamanders consume worms, snails, slugs, and both waterborne and terrestrial insects and their larvae. In the woodlands, salamanders seek leaf mold, decaying logs, and moist spots under rocks for food and shelter. The diet of frogs and toads include insects, spiders, mites, and worms. Leaving intact leaf litter and rotten logs in your woods will help provide these animals with important cover. Toads in particular are beneficial to gardeners because they consume insects that are harmful to flowers,



Vermont is home to 11 species of snakes, and most of these species are less than 3 feet long.

vegetables, and other plants. Attract toads by placing an old stump or hollow log in your garden. Propping up pieces of wood or turning a flower pot on its side, will give toads a damp, shady daytime haunt.

When working in the woods, leave lots of coarse woody debris in the form of branches, downed logs, and dead trees. Woods that look like city parks are not good habitat for amphibians, reptiles, or other wildlife. This organic material provides moisture, food, and cover. Abundant shade keeps the woods cool and moist.

Many amphibians depend on streams or seepage areas to feed, lay their eggs, overwinter, or maintain their body moisture. Keep streams shaded and free of sediment and leave a naturally vegetated buffer where they can feed during night-time rains. (For more on this, see **Chapter 14, "Riparian Habitat Management**.")

Management Practices for Snakes

Unlike amphibians, reptiles do not have a water-dependent larval stage. However, many species live in or near wetlands and waterways where they find food and shelter. Creating, restoring, and enhancing wetlands is generally beneficial to snakes and turtles as well. Aquatic snakes spend much of their time in or near the shallower edges of lakes and streams. Nearby uplands are the feeding grounds favored by most snakes, Vermont's one lizard species, the wood turtle and the eastern box turtle.

Figure 30.2
Brown snake. Courtesy of Jim Andrews.

Vermont is home to 11 species of snakes, and most of these species are less than 3 feet long. However, most Vermonters would be surprised to learn that Vermont is home to one of the largest snakes in North America. The eastern ratsnake can grow up to 8 feet long and has been seen at lengths of nearly 6 feet here in Vermont. Unfortunately this docile snake is often killed out of fear. Vermont is also home to the timber rattlesnake, a venomous snake that inhabits rockslides, ledges, and nearby forests. Although this snake is not at all aggressive, it is venomous and should not be handled.

Vermont's most abundant snake is the common garter snake, which occupies open woodlands, meadows, and old fields. Another Vermont snake that prefers a similar habitat type is the eastern milk snake, which can also frequent barns and sheds. Wet lowland meadows, marshes, and the grassy edges of lakes and streams are preferred by the eastern ribbon snake. The smooth green snake prefers upland pastures, power lines, and beaver meadows. Vermont's only water snake, the northern water snake, inhabits lowland shallow wetlands with emergent vegetation and nearby rocks. This snake is primarily found near scattered marshes in the Lake Champlain Basin.

Following are some options you should consider when managing habitat for snakes:

- When trimming trees or shrubs or harvesting timber, leave brush in piles to provide shelter.
- Maintain stone piles and stone walls that get lots of sun on well-drained slopes, which are attractive basking and hibernation locations and also provide shelter from predators.
- Maintain open, sunny places for basking within dense woodlands to help snakes regulate temperature.

- Leave at least a 50-foot uncut buffer around ponds and water edges for feeding sites and cover.
- Mowing fields and bailing hay are threats to snakes. Cut open areas only as frequently as is necessary, cut as high as possible, and leave the clippings if not being used for hay.
- Be careful how and where you use a string trimmer. Snakes will hide from predators in tall grass on the edge of lawns, and are often killed by electric trimmers.

Management Practices for Turtles

Vermont is home to seven species of turtles. Probably the most-recognized turtles in Vermont are the snapping turtle and the painted turtle. These turtles require slow-moving or still water with soft bottoms and emergent vegetation such as cattails. Vermont's less common turtles include the wood turtle and the northern map turtle. Wood turtles are primarily river turtles that prefer streams with moderate slopes and speeds. They feed primarily in the upland and field sites adjacent to the stream systems and rely on the streams for refuge and wintering sites. Map turtles in Vermont are primarily aquatic; they come on land only to bask and lay eggs. Vermont's rare turtles are the spiny softshell, spotted, and eastern musk or stinkpot turtles. Spiny softshells are entirely aquatic and are found only in the northeastern region of Lake Champlain. Spotted turtles are both terrestrial and aquatic; they travel between uplands and wetlands. Eastern musk turtles are also entirely aquatic, preferring shallow weedy still water.

All of Vermont's female turtles dig a nest hole in the ground with their hind legs to bury their eggs. Nest sites are located in moist soils or sand in open, sunny areas near water with little or no obstructing vegetation. When nesting sites are not available, turtles may travel a considerable distance to find them, thus increasing their vulnerability. Stream bank stabilization, though an excellent conservation tool, can often eliminate nesting sites for wood turtles.

Most female turtles lay their eggs in May to early June and the young hatch in late summer or early fall. Because some hatchlings may over-winter in the nest, these sites must remain undisturbed all year. Turtle eggs are a popular food for nest predators such as raccoons, skunks, and opossum.

As a landowner, you can provide nesting habitat by creating small sand or gravel piles in slightly elevated, sunny places near pond or lakeshores to prevent flooding of the nest. These piles need to be kept free of all tall vegetation. Turtle eggs can tolerate grass roots but other roots will kill them. Because some aquatic turtles spend the winter on the bottoms of lakes and ponds, the sites must not freeze to the bottom in the winter. Lakes and ponds with depths of 5 feet or more are proven wintering habitat for aquatic turtles. Eastern box turtles (a possible Vermont breeder) dig into the leaf litter and hibernate in the forest.

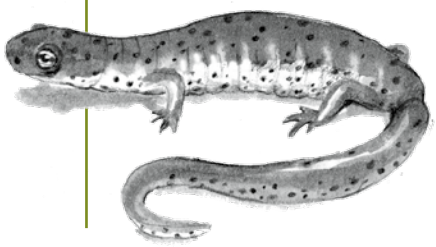
Many species of turtles need to bask in order to raise their body temperatures. Leave downed trees along the edges of ponds, rivers, wetlands and lakes to provide adequate basking locations.

Vermont is home to seven species of turtles. Probably the most-recognized turtles in Vermont are the snapping turtle and the painted turtle.

RESOURCES

Partners in Amphibian and Reptile Conservation. 2006. *Habitat Management Guidelines for Amphibians and Reptiles of the Northeastern United States – Technical Publication HMG-3.*

Vermont Reptile and Amphibian Atlas. http://vtherpatlas.org/



➤ PAGE 125

31. BEES AND OTHER PLANT POLLINATORS

Plants critical to wildlife that benefit from animal pollination include blueberry, blackberry, apple, and serviceberry. Without bees, these plants that sustain bear, deer, turkey, and moose would be far less productive.

Photo courtesy of Leif Richardson.

SUMMARY

Bees are an important pollinator for many plants upon which other wildlife depend. Promoting bees on your property helps pollination of maples, apple trees, berries, and other fruits, which in turn promotes both non-game and game species such as deer, bear, and turkey. Landowners wishing to manage for bees and other pollinators should maintain a diversity of forest types, promote the growth of native flowers and flowering plants, and avoid the use of many types of pesticides on their gardens and crops.

NATURAL HISTORY

Plants form the base of the food chain, the structure of the habitat, and the cover necessary for all species of Vermont's wildlife. To manage these plant-based habitats effectively for birds, mammals, and other wildlife, the processes that sustain them must be understood. And critical to plant reproduction is the role that bees, flies, beetles, moths, butterflies, and other animals play in moving pollen from one flower to the next. This section will focus on managing bee habitats, since bees are by far the most important pollinators.

The recent population crashes of commercial honeybee colonies have raised awareness of bees' importance to people and wildlife as crop pollinators, as 60 to 80 percent of wild plants are dependent on bees and other pollinators. Plants critical to wildlife that benefit from animal pollination include blueberry, blackberry, apple, and serviceberry. Without bees, these plants that sustain bear, deer, turkey, and moose would be far less productive.

Approximately 4,000 species of bees are native to North America, and about 275 of these are found in Vermont. Honeybees are not native to this continent, and, in their current state, are relatively unimportant pollinators in natural settings. These bees all have one important habit in common: they feed their offspring pollen. In gathering this food from flowers, bees inadvertently transfer pollen grains from one plant to the next, thus allowing the plants to form seeds and fruits. Bumblebees are highly visible examples of this foraging strategy, readily switching from one type of plant — and habitat — to the next. About 20 percent of our bees are pollen specialists, meaning that they are adapted to gather pollen from just one plant family, genus, or even species.

Most of our wild bees are known as "solitary bees," meaning that they lack the complex social structure of honeybee colonies. Females of these species establish solitary nests, provision their eggs with pollen, then die before their offspring emerge. Though some solitary bees nest in communal aggregations, the adult bees have little interaction with each other.

By contrast, the societies of our social species feature cooperation, a division of labor, and much communication. The most visible of these are the bumblebees, which establish colonies in spring to early summer.

HABITAT REQUIREMENTS

Bees have three basic habitat requirements: nesting sites, overwintering sites, and access to the plants to which they are adapted. Most of Vermont's wild bees nest in tunnels they dig in sandy, silty, or loamy soils. Flat or gently sloping substrates are generally preferred, and the bees often choose areas with sparse vegetation. Examples of ground nesting bees are the many species of mining bees and sweat bees found here. About one-quarter of the bees in this area nest in preformed cavities they find in twigs, acorns, snail shells, tree trunks, and other wood. Many of these bees seal their nests with 'doors' made of chewed leaves, which has earned them the name 'leafcutter bees.' Bumblebees nest in old rodent dens, above-ground cavities in dead trees, under tussocks of dry grass, in heaps of decomposing plant matter, and many other places. And, a small number of bees actually excavate their own nest cavities in sound wood. This includes the large carpenter bees, which are found only in extreme southernmost Vermont.

Figure 31.1
Meadow with native wildlife flowers.

When managing for bees and other pollinators, maintaining an abundance and diversity of flowering plants throughout the growing season is critical. Trees such as maples, willows, and apples are important sources of bee food in early spring. Spring wildflowers found in the understory of hardwood forests are critical to large number of bees that also pollinate the fruiting trees and shrubs many other animals depend on. Open wetlands feature many pollen and nectar sources for bees, including blueberries, cranberries, Labrador tea, water lilies, Joe-Pye weed, and asters. Fields and other openings usually support suitable bee forage. Farms and gardens can offer excellent bee forage. Plants that do not offer forage to bees include those that are wind pollinated, such as beech, birches, oaks, grasses (including corn), sedges, and the non-flowering plants like ferns and horsetails.

Adult bees do not migrate, but seek winter shelter in underground cavities, hollow twigs, and other places. Little is known of the requirements of bees in winter, but they are thought to seek shelter that is protected, dry, and relatively stable in temperature.

MANAGEMENT PRACTICES

Loss of habitat is implicated in the declines of some bumblebees and other pollinators. Subdivision, development, and greatly intensified agricultural operations have been shown to reduce bee abundance and diversity.

Fortunately, managing for bees and other pollinators involves many of the same practices employed for other wildlife. In general, habitat diversity will lead to a diversity of bees and other pollinators. Bees must have continuous access to an array of native flowering plants, which can be achieved by maintaining a patchwork of mature forest, forest with sunny openings, functioning wetlands, old fields with a mix of flowering forbs and shrubs, and fields with areas that are not heavily cropped for

When managing for bees and other pollinators, maintaining an abundance and diversity of flowering plants throughout the growing season is critical.

➤ PAGE 127

corn or hay. Patches of flowers on the margin of farm fields, lawns, and in hedgerows can be critical to bees, and should be maintained. Bees are attracted to the flowers of some invasive plants (e.g., purple loosestrife), but others may impoverish bee habitat by crowding out native flowering plants. Plants favored by bees include goldenrod, aster, and sunflowers, willows, blueberry family plants (including blueberries, cranberries, and maleberry), dogwood, spring beauty, native species of loosestrife, and pickerel weed.

To manage your property for bees, consider the nesting needs of the bees at work on your land. The sparsely vegetated and uncompacted soils of hedgerows, dry banks, and forest roads are often inhabited by nesting bees. Tilling is detrimental to nesting bees, so leave some areas fallow among row crops. Maintain an abundance of woody material that might house cavity nesters, including pithy plant stems, sumac, and logging slash. When conducting habitat improvement work such as apple tree release, consider leaving some dead wood as nesting habitat for bees. And just as you can provide nesting boxes for wood ducks and bluebirds, you can augment nesting habitat by providing blocks of wood with predrilled holes in them, as well as shoebox-sized wooden boxes for bumblebees.

One of the greatest detriments to bees is the widespread use of pesticides. Limiting the use of these chemicals in agricultural and other settings will benefit bees and the wildlife that depend on their services. Of particular concern are pesticides applied as dusts or small pellets, those applied to flowering plants, and the neonicotinoid class of pesticides.

Finally, you should pay attention to the activities of bees on your property. Noticing trends in bee abundance on plants from year to year can help you evaluate whether you are getting this valuable ecosystem service. Poor fruiting of apples, blueberries, and other plants mentioned above may signal a need to increase pollinator habitat. Becoming familiar with a few of the more obvious pollinators may aid you in this type of monitoring.

RESOURCES

U.S. Department of Agriculture. National Resources Conservation Service. “How Farmers Can Help Pollinators.” http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/farmers/

Agroforestry Notes.

—. “Improving Forage for Native Bee Crop Pollinators.” http://www.plants.usda.gov/pollinators/Improving_Forage_for_Native_Bee_Crop_Pollinators.pdf

—. “New England Pollinator Handbook.” November 2009. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_010204.pdf

—. “Pesticide Considerations for Native Bees in Agroforestry.” http://www.plants.usda.gov/pollinators/Pesticide_Considerations_For_Native_Bees_In_Agroforestry.pdf

Xerces Society of Invertebrate Conservation. “Pollinator Habitat Guidelines.” http://www.xerces.org/pollinator-conservation-managing-habitat/

APPENDIX A

SAMPLE TEMPLATE FOR HABITAT PLAN

FOREST & WILDLIFE HABITAT MANAGEMENT PLAN

TEMPLATE

While there are many ways to develop and format a forest and habitat management plan, how a plan is developed can be effected by the size of the property, the complexity and diversity of the habitat conditions, and the types of interests the landowner may have. Reasons for developing a plan, such as the Vermont UVA requirements for forest management plans, may also dictate the format used. Maps are also an important part of the planning process. Consider using the ANR Atlas (http://anrmaps.vermont.gov/websites/anra/) to create yours. Note: This template is one example of how a habitat management plan could be constructed and organized, and should be used as a general guide.

I. Describe the Property

- Property name, location, and plan owner

  _____

  _____

  _____

- History of land use (agricultural use, past timber harvesting, old roads, recent development)

  _____

  _____

  _____

- Acreage of the property _____

- Boundary descriptions (attach a map of the property boundaries)

  _____

  _____

  _____

  _____

  _____

  _____

- Infrastructure (access and roads, historic sites – cellar holes, stone walls, parking areas – these will need to be added to your plan map)

  _____

  _____

  _____

- Landscape Context — how and where the property fits into the neighboring landscape relative to other property owners, conserved lands, forest blocks, nearby development:

_____
_____
_____

- Significant features — any rare species or unusual geological conditions:

_____
_____
_____

- Create a map that illustrates these various features and provide context for where the property is located and how the boundaries are configured relative to other natural resource and cultural resource features. The ANR Atlas tool is a good resource for this.

II. Explain the Purpose and Outline Goals of the Plan

- Why are you developing a management plan for your property (what is the purpose of the plan)?

_____
_____
_____

- What is your vision for the future of your land?

_____
_____
_____

- What feature/s is/are most important to you about your land?

_____
_____
_____

- What are your goals and objectives for the property?

_____
_____
_____
_____
_____
_____

III. Inventory and Assess the Habitat Conditions and Other Natural and Cultural Resources

As mentioned above, a map is critical for illustrating much of this information. Creating a comprehensive map will be one of the most important tools for guiding the application of management strategies.

- Describe past and current habitat conditions such as meadows, forest types, natural communities, wetlands, streams, ponds, vernal pools, seeps, ledges, areas of concentrated mast trees.

- Describe fine scale habitats such as number of dead and dying trees per acre, presence or absence of brush piles, number of downed logs per acre.

- Describe observations and evidence of wildlife that occur on the property such as types of songbirds observed or heard, ruffed grouse drumming, animal tracks (e.g., fox, coyote, deer, moose), browsing of saplings by deer or snowshoe hare, nest sites of wood ducks or Canada geese, photos of wildlife from "game cameras", etc.

- Describe the broader landscape beyond the property boundaries. For instance, if the property is located in the northern Green Mountain biophysical region, it would be important to note whether the property is located within a large block of unfragmented forest habitat (**see ANR Natural Resources Atlas and BioFinder for more information**), or instead, if it's located within an agricultural landscape. Another important landscape factor to consider is where the property fits into any wildlife travel corridors or linkage areas (see the same references above).

- Create a map that illustrates locations of stone walls, roads, old home foundations, monuments or other important cultural features of the property as described in Part I. It may be important to avoid and protect those areas.

- Describe the forest conditions of the property for purposes of managing forest resources. This is important because many habitat management plans will be part of forest management plans that have goals for timber management and production.

IV. Develop Management Strategies and a Schedule

- Describe specific actions that you intend to take in order to achieve the goals and objectives of the plan. These may include harvesting of timber, mowing of meadows, brush-hogging of young forest, pruning of apple trees, planting trees along stream buffers, controlled burning of grasslands, delayed mowing of grasslands, and installation of artificial nest structures, among many others detailed in these guidelines.

- Develop a schedule that establishes dates when the various strategies will be implemented and when they will be complete. If those dates need to be adjusted over time, make the necessary revisions because it will force you to ensure that you complete all the necessary strategies to achieve the goals and objectives.

- Using the map of features you developed in part three, create an overlay that depicts the location and extent of where the strategies will be applied on the property.

- Take and date photos of the areas where various actions will be implemented prior to and after they have been applied. Photo documentation can be a rewarding way of appreciating the effort that goes into implementing your strategies.

A Landowner's Guide –

Wildlife Habitat Management for Lands in Vermont

Vermonters place high value on the state's environment, rural working landscape, and wildlife. Time and again, these values are highlighted in surveys that illustrate strong public support for conservation of wildlife and land. As the Vermont landscape comprises largely private land, Vermont landowners play a critical role in ensuring the future health of Vermont's lands, waters, habitats, and wildlife. And, time and again, Vermont landowners provide outstanding examples of managing land in thoughtful ways to benefit the shared interests of wildlife.

This guide is intended to assist you as a landowner to manage your land to benefit wildlife in tandem with other management goals you might have, such as for timber or hiking trails; many of these goals are compatible, if not complimentary. Managing your land to enhance its value for wildlife requires careful attention to the species of plants and animals currently using the land as well as those desired from your management. Whether you are a landowner, forester, biologist, or other land manager, this guide will help you understand how to recognize various wildlife habitats and how to manage them for the future, for many generations of Vermonters yet to come.

1 National Life Drive
Montpelier, Vermont 05620
802-828-1000
www.vtfishandwildlife.com

ISBN 0-9772517-2-1