

Conserving Vermont's Natural Heritage

*A Guide to
Community-Based Planning
for the Conservation of
Vermont's Fish, Wildlife,
and Biological Diversity*



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for the Conservation of Vermont's
Fish, Wildlife, and Biological Diversity*



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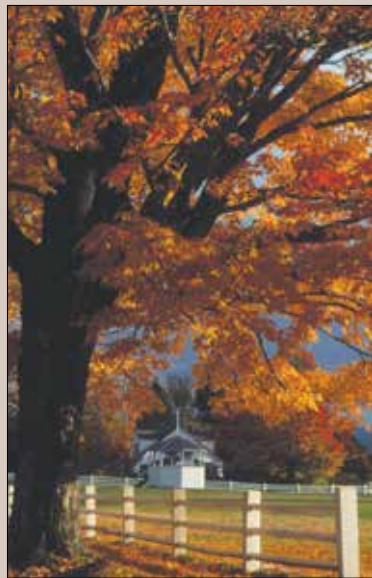
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The image people have of Vermont is not beyond its reality. The descriptions of wild beauty interspersed with the purity of northern New England villages need not be exaggerated. Residents of the state have always been proud of these attributes and are protective of their territory, and for outsiders who visit at any time of year, Vermont is a release from the intensity and sameness that grip many other parts of America.

~ Charles Johnson, *The Nature of Vermont*

Preface and Acknowledgments

The Vermont Fish and Wildlife Department (VFWD) developed this manual to offer a new source of information and technical guidance on conservation planning in Vermont. Experience and research has taught us a great deal in recent years about how to conserve fish, wildlife, and the natural environment that supports them. Among the many lessons learned is that citizens of Vermont care a great deal about the fish, wildlife, habitats, and lands in their state and are eager to learn more about how to effectively conserve them.

There is a growing interest in local, community-based conservation efforts. Town planning and conservation commissions, watershed groups, regional planning commissions, state agencies, land trusts, and many others are becoming more active in conservation planning. Whether these organizations and groups are motivated by increased risks to their interests in land, wildlife, and outdoor pursuits, or whether they are motivated by a greater understanding of conservation needs, they are increasingly important partners in the future of fish and wildlife conservation in Vermont. We wish to foster and encourage this enthusiasm for conservation of fish, wildlife, and natural landscapes.

This manual offers choices and opportunities to Vermont communities and others who engage in land use and conservation planning efforts. It provides a process, information, and ideas for how to incorporate fish, wildlife, habitat, natural communities, the landscape, hunting, fishing, wildlife watching, and working lands into local and regional planning documents, zoning regulations, and other conservation instruments. There are many processes and methods for addressing natural resource conservation through land use and conservation planning, and the reader is encouraged to consider other ideas and options beyond those presented in this manual. This manual will enable Vermont communities and planners to consider several natural resource elements in a realistic, pragmatic fashion so that this and future generations of citizens and visitors can enjoy the wealth and grandeur of Vermont's natural resources.

The Department and in particular the authors of this manual wish to thank all those who have contributed to the development and refinement of this manual, including: The Vermont League of Cities and Towns (Jon Groveman and Karen Horn) who authored Chapter 7; Elizabeth Thompson, consulting ecologist, who authored Chapter 6 and many other parts of the manual, as well as invested countless hours editing and revising the document; Wayne Laroche, commissioner, Department of Fish and Wildlife; Jonathan Wood, commissioner, Department of Forests, Parks and Recreation; Alan Quackenbush; Cathy Kashanski; Eric Sorenson; Mark Ferguson; Gina Campoli; Faith Ingulsrud; Andrew Flagg; Susan Morse; Kim Royar; Rod Wentworth; Bill Rossmassler; Doug Blodgett; Dave Capen; Terri Donovan; Bob Popp; Bill Leopold; Debra Brighton; Kevin Behm; Marty Illack; Virginia Rasche; Kevin Viani; and all the others who have offered support and inspiration for this project.

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We also wish to thank Linda Mirabile, Rebecca Davison, and Cathy Donahue for their patience and perseverance in working with us on the editing and design of the manual.

Finally, we wish to recognize the United States Fish and Wildlife Service for their financial support without which this project would not have been possible.

Table of Contents

| | |
|----------------------------------------------------------------------|------------|
| Preface and Acknowledgments | 4 |
| Part I. <i>Laying the Groundwork for Conservation</i>..... | 7 |
| The Value of Vermont’s Natural Heritage..... | 8 |
| What Towns Can Do..... | 9 |
| How to Use This Book..... | 10 |
| Chapter 1: Vermont’s Natural Heritage | 11 |
| ▶ The Natural Landscape of Vermont..... | 12 |
| ▶ Threats to Vermont’s Natural Heritage..... | 17 |
| Chapter 2: Conservation Planning | 26 |
| ▶ Status of Vermont’s Conservation Planning..... | 27 |
| ▶ Conservation: The Planning Process..... | 28 |
| | |
| Part II. <i>Natural Heritage Elements</i> | 35 |
| Chapter 3: Landscape-Level Elements | 38 |
| ▶ Contiguous Habitat..... | 39 |
| ▶ Connecting Habitat | 48 |
| ▶ Enduring Features | 53 |
| Chapter 4: Community-Level Elements | 57 |
| ▶ Natural Communities | 58 |
| ▶ Wetlands | 62 |
| ▶ Riparian and Aquatic Habitat | 66 |
| ▶ Vernal Pools | 74 |
| Chapter 5: Species-Level Elements | 79 |
| ▶ Rare, Threatened, and Endangered Species | 80 |
| ▶ Deer Wintering Areas..... | 85 |
| ▶ Mast Stands | 89 |
| ▶ Important Bat Habitat | 92 |
| ▶ Important Turtle Habitat | 94 |
| ▶ Grassland and Bird Habitat | 96 |
| ▶ Early-Successional Forest and Shrub Habitat | 99 |
| | |
| Part III. <i>Bringing Vision and Reality Together</i>..... | 105 |
| Chapter 6: Conservation Planning in Ridgeville, Vermont | 106 |
| ▶ Step One: Setting Vision and Goals | 107 |
| ▶ Step Two: Gathering and Interpreting Information | 111 |
| ▶ Step Three: Developing Conservation Strategies | 113 |
| ▶ Step Four: Implementing Conservation Strategies | 115 |
| Chapter 7: Tools for Making Conservation a Reality | 117 |
| ▶ Planning | 118 |
| ▶ Zoning and Subdivision Bylaws | 122 |
| ▶ Non-Regulatory Tools | 126 |
| | |
| End Notes | 128 |
| Bibliography and Works Cited | 130 |
| Appendix: Where to Get Data and Technical Assistance..... | 132 |

PART I

Laying the Groundwork for Conservation





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Conserving Vermont's natural heritage is paramount to protecting our way of life.



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The Value of Vermont's Natural Heritage

It is no mystery why people enjoy living in and visiting Vermont. This state has what so many other once rural places have lost: a wealth of wildlife and scenic beauty, traditional working landscapes that support viable local economies, and desirable social and cultural attributes — low crime, helpful neighbors, and close-knit villages and towns.

Wildlife, scenic beauty, and the landscape that supports this way of life are not only vital parts of Vermont's rural character and identity, but are highly valued by Vermont residents. Based on 2001 public survey results from the U.S. Fish and Wildlife Service, Vermont ranked first in the nation in percentage of residents that actively observed wildlife (60%). The results also show that hunting, fishing, and wildlife viewing expenditures in Vermont totaled \$386 million, an increase of \$6.42 million since the last survey in 1997. At least 280,000 Vermont residents participate in wildlife-associated activities. This constitutes nearly 50% of the state's resident population — the highest percentage in the nation.

In addition, approximately 307,000 non-residents

participate in wildlife-associated activities in the state. These statistics represent a significant contribution to the state's economy and underscore the strong connection Vermont residents and non-residents have to their land and wildlife.

The term “natural heritage” means all the natural resources Vermont residents and visitors value. Vermont's diverse resources, which include forests, clean waters, vibrant fisheries, healthy wildlife populations, rare species, significant natural communities,* and a working landscape, provide people with the opportunity to, among other things, hike, hunt, fish, trap, birdwatch, and work the land. Natural heritage also includes the concept of *biodiversity*, which is the variety of life in all its forms and all the interactions between living things and their environment. Biodiversity is measured at the following levels: ecosystem, landscape, community, species, and genetic.

* *Natural communities* are defined as interacting assemblages of organisms, their physical environment, and the natural processes that affect them (Thompson and Sorenson, 2000).

According to a 2002 report from the Vermont Biodiversity Project, *Vermont's Natural Heritage*, Vermonters care about their natural heritage for many reasons. They care about healthy ecosystems that provide clean water and vital fisheries; they enjoy the solace of hunting, fishing, and hiking; they appreciate that Vermont's landscape provides food and medicine.

The Vermont Fish and Wildlife Department, along with other organizations, departments, and agencies, promotes the conservation of Vermont's natural heritage through careful stewardship of working lands combined with the conservation and protection of important habitats, natural communities, riparian lands, and contiguous forest.

To sustain Vermont's rural character, fish, wildlife, and overall natural heritage for future generations, it is imperative that conservation be one of our highest priorities. This means protecting our fish, wildlife, plants, natural communities and the ecological processes and landscapes that allow them to exist. Although the decisions may be challenging and complicated, the outcome will last well beyond our lifetime and no doubt be greatly appreciated by those who will follow us.

What Towns Can Do

Vermont's towns and cities are indispensable partners in the conservation of Vermont's fish, wildlife, and natural heritage. As Vermonters, we have always been fortunate to share our landscape with a broad diversity of animal and plant species. But how do we live with these other species without harming them or, even worse, losing them? What can we do in our communities, towns, and regions to make better land management decisions to ensure the continuation of the animals, plants, natural landscapes and all the benefits we enjoy from them?

This manual will help answer these questions. It explains how to:

- ▶ conserve the elements of Vermont's natural heritage through local and regional conservation planning and land stewardship;
- ▶ find information on local and regional natural heritage elements (for example, significant wildlife habitat);
- ▶ establish goals and strategies for protecting and conserving these elements; and
- ▶ understand the natural heritage elements within a town or community and their regional significance to the surrounding landscape.

Vermont Survey

- ▶ **89%** of Vermont residents surveyed indicated it is important that seldom-seen species exist in Vermont.
- ▶ **95%** of Vermont residents surveyed indicated that knowing Vermont's native fish and wildlife populations are healthy is very important, even if they don't see them.
- ▶ **63%** of Vermont residents surveyed strongly support the Department working with planning commissions for habitat protection/conservation.
- ▶ **97%** of Vermont residents surveyed indicated that it is important to them that ecologically important habitats and lands in Vermont are protected.
- ▶ **48%** of Vermont residents surveyed agreed that towns should be able to restrict the amount of residential growth. Of those surveyed 75% agreed that wildlife habitat must be protected even if it reduces the land use options of some landowners and developers.
- ▶ **45%** of Vermont residents surveyed said they did not agree with the statement that suburban sprawl is not yet a problem in the state.
- ▶ **48%** of Vermont residents surveyed indicated that population growth had an effect on the quality of the state's lakes, rivers, and streams.
- ▶ **80%** of Vermont residents surveyed indicated that it is important to have the opportunity in this state to participate in wildlife-related outdoor activities, such as hunting, fishing, and wildlife viewing.



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How to Use This Book

This book is for conservation and land use planners. Its main purpose is to help planners find and understand information on the elements of Vermont's fish, wildlife, and natural heritage so that they can make sound conservation choices and decisions. Although the book is aimed primarily at municipal-level planning, the concepts and information also apply to planning for individual parcels of land, watersheds, multi-town areas, biophysical regions, or even larger areas.

There are many sources of useful and important information on this subject (see literature cited). *Vermont's Natural Heritage*, a 2002 report from the Vermont Biodiversity Project (VBP), provides background information that explains the science behind conservation and protection of Vermont's natural heritage elements. It also provides ideas for statewide conservation goals. Understanding the science of conservation and knowing about the statewide perspective can help towns and other organizations plan for the conservation of species, natural communities, and landscapes throughout the state.



Chapters 1 and 2 of this manual outline the planning process for the conservation of a community's natural heritage and provide the information needed to understand the remainder of the manual. Technical material, including reference to Geographic Information Systems (GIS) software, appears throughout this manual. This software is explained briefly in Chapter 2 for those who are interested in its application. Regional planning commissions or other experts can assist in applying some of the technical computer mapping and analysis techniques. Good conservation planning can occur, however, without GIS or even computers.

Chapters 3 through 5 contain detailed information on the three levels of elements of Vermont's natural heritage: landscape, community, and species. This is a reference section to be used for organizing information that will be important for creating a comprehensive conservation plan.

Chapter 6 demonstrates, through the example of the fictitious town of Ridgeville, how to develop a conservation plan from stating a vision to adopting specific conservation strategies, and Chapter 7 provides information on the laws, regulations, and other tools you can use in implementing your conservation plan. These two chapters explain how towns, as well as individual landowners, private conservation groups, and government agencies can use the information described in this manual for planning, regulating, and directing development, among other actions.



©LANDSLIDES AERIAL PHOTOGRAPHY

As the result of strict zoning controls, farmland along the highway corridor in Waitsfield has no housing development, looking much as it did 50 years ago. Source: "Above and Beyond," 2002.

The Appendix provides contact information for agencies and organizations that may be helpful in developing, refining, and implementing conservation plans.

CHAPTER I



Vermont's Natural Heritage



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Vermont's landscape is a rich tapestry of mountains, valleys, woods, and wetlands, with a fascinating geological history.

It is Vermont's natural landscape that enriches the lives of those who live here and draws so many visitors to the state. It is this same landscape that provides us with clean air, clean water, and habitat for thousands of species of plants and animals.

Understanding Vermont's natural heritage requires understanding the physical landscape. The configuration of mountains, valleys, wetlands, lakes, and rivers is crucial in determining the distribution of natural communities, habitats, and native species.

The following broad environmental factors influence the distribution of species, habitats and natural communities: climate, bedrock geology, surficial geology, topography, hydrology, and land use history.

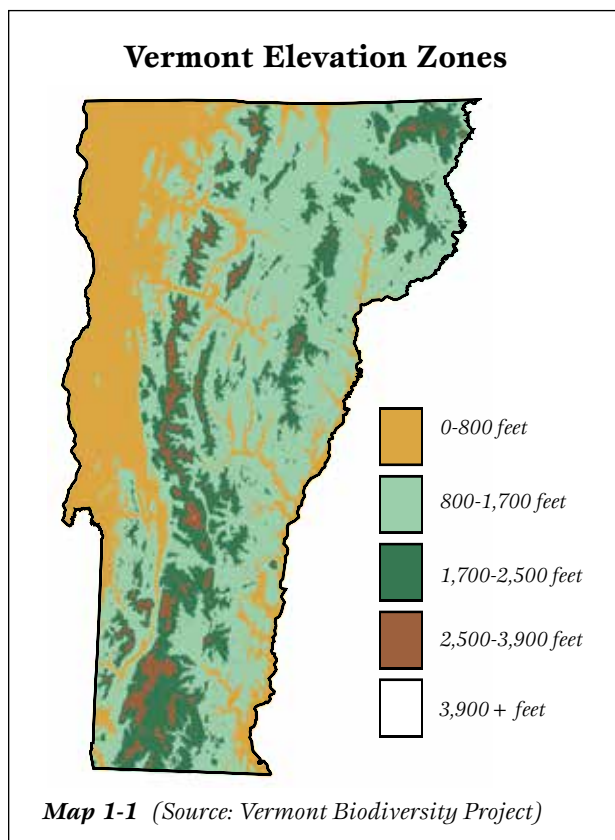
The conservation of Vermont's natural heritage necessitates that we provide for habitats across the full spectrum of these six factors.

The Natural Landscape of Vermont

Climate

Vermont's lowest land point is the shore of Lake Champlain, only 95 feet above sea level. Vermont's highest point is the Chin on Mount Mansfield, which rises to 4,393 feet. The distance between Lake Champlain and the Chin is just 20 miles, but in that distance, the climate, topography, and vegetation change dramatically. On the shores of Lake Champlain, where the growing season is 150 days, tall shagbark hickories dot the landscape and peaches and apples grow in orchards. On the top of Mount Mansfield, where the growing season is limited to about 90 days, balsam fir grows in stunted and contorted mats, bending to the incessant winds. This dramatic change is due largely to elevation and exposure. It is the striking topography of the state that dictates Vermont's great variability in climate.

Climate is crucially important in determining the distribution of natural communities, habitats, plants, and animals. Elevation is used as a substitute for climate because it is the major factor influencing climate in Vermont and because elevation is easy to measure and map.



Bedrock Geology

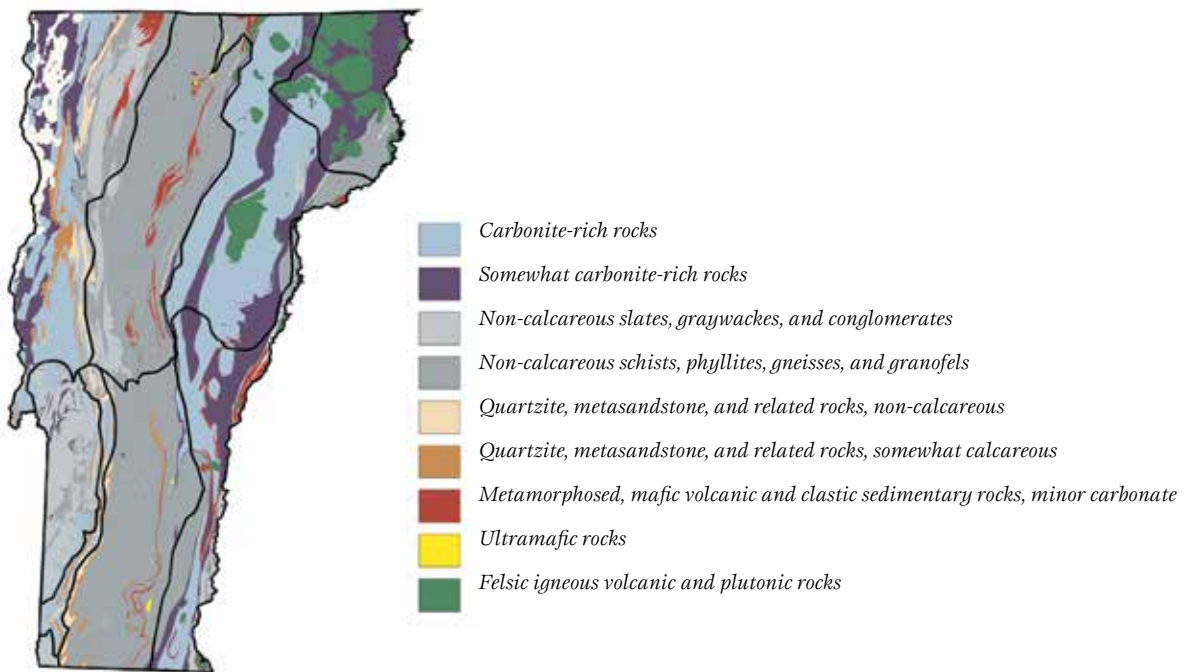
Bedrock geology refers to the origin and composition of the rock that underlies all soil and vegetation. Vermont's bedrock has a rich history. The rocks that make up the Southern Green Mountains were formed more than 570 million years ago. The rocks of the Champlain Valley and the Northern Green Mountains date from a time 540 to 443 million years ago when Vermont was the edge of a warm, tropical sea. The remains of marine mammals that inhabited that sea can be found in the Champlain Valley's limestone rock. The youngest rocks in Vermont are the granites, like the stone that makes up the Barre granite quarries. These rocks were formed 200 to 400 million years ago as a result of deep underground magma welling up and hardening. Granite is one of the dominant bedrocks in the Northeastern Highlands.

Whether the bedrock is limestone or granite — or some other kind of rock — is particularly important in the distribution of natural communities and plants because each kind of rock has its own unique chemical composition. Rich Fens, a rare type of wetland, occur almost exclusively in areas where limestone or similar calcium-rich rock is prevalent because the plants that grow in these fens require calcium. The rare Green Mountain Maidenhair fern grows only on a specialized bedrock type known as serpentine — the rock from which asbestos is mined. This rock contains especially high levels of magnesium, to which the fern has adapted over evolutionary time. Some animals respond to changes in bedrock geology as well. For example, the rare Taconic Cave amphipod — a crustacean, related to shrimp — occurs only in limestone caves. These caves also serve as critical habitat for hibernating bats and other species in Vermont.



Fig. 1-1 This cross section of a landscape in the Vermont Valley shows that bedrock (straight or wavy lines) underlies everything, but in some places the surficial deposits (pebbly gravel and dark-hatched peat) cover the bedrock and have a greater influence on the vegetation. (Source: Darien McElwain, “Wetland, Woodland, Wildland”)

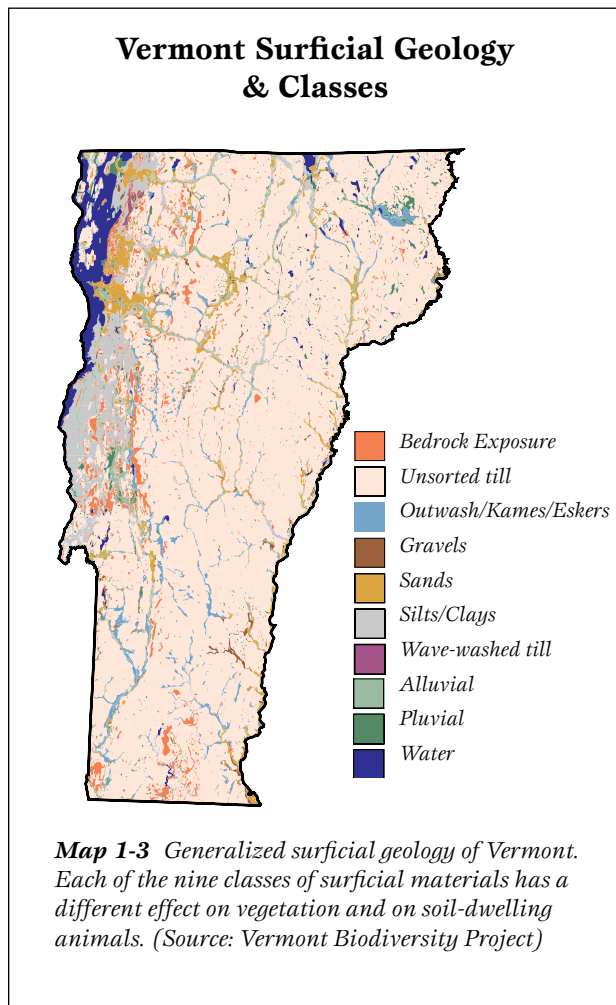
Bedrock Geology of Vermont



Map 1-2 This map was developed for the Vermont Biodiversity Project from an existing map of the bedrock geology of Vermont (Doll, 1961). The nine classes of rock are defined by their ecological influence rather than on their origin or age. Generally, the rocks that dominate much of the Green Mountains (grey on the map) are acidic, whereas the rocks that dominate the Champlain Valley and the eastern part of the state (blue on the map) are basic because they are buffered by carbonates. (Source: Modified from Doll, 1961, by Marjorie Gale and Laurence Becker, Vermont State Geologist Office. Used by permission.)



Fig. 1-2 Surficial soils influence vegetation, often resulting in unique natural communities such as the Valley Clayplain Forest. This community grows on the clay soils of the Champlain Valley. These soils and the flat topography in which they're located make good agricultural lands, resulting in the clearing of much of the valley's original Clayplain Forests. (Source: Libby Davidson, "Wetland, Woodland, Wildland")



Surficial Geology

Vermont's surficial geology is defined by the sands, gravels, clays, peats, and other deposits found on top of the bedrock as a result of both glacial activity and post-glacial events (like flooding) that continue today. Bedrock and surficial geology together have a profound influence on the soils in which Vermont's plants grow. In some places, the surficial deposits can mask the effects of bedrock. For example, the deep clay soils of the Champlain Valley support a natural community type — Valley Clayplain Forest — that was common prior to large scale conversion to agricultural use, and now remains only in scattered remnants. The sand deposits in Chittenden County and elsewhere support the imperiled Pine-Oak-Heath Sandplain Forest community.

Topography

Topography is the fourth factor of the physical landscape that influences the distribution of plants, animals, and natural communities. The soil on a ridge top is shallow and dry, whereas the soil at the base of a slope tends to be deep, moist, and rich in organic matter and nutrients that have filtered down. To better understand topographic variations in Vermont, the Vermont Biodiversity Project developed a classification of landforms based on topography and other geologic factors. The classification identifies 16 kinds of landforms that appear to influence the

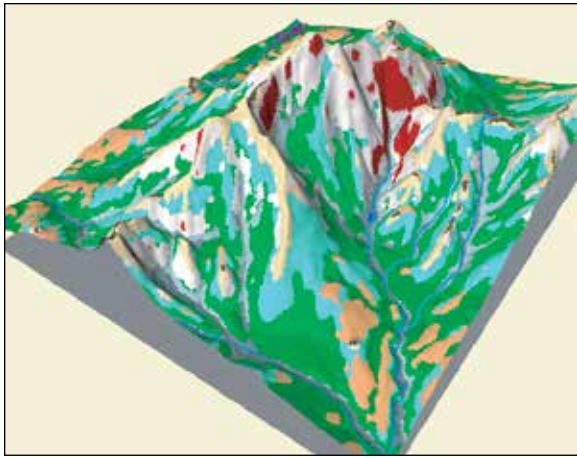


Fig. 1-3 This diagram of the Mount Mansfield region, looking north from Stowe into Smugglers Notch, shows that there are many different landforms, from cliffs to side slopes to valley bottoms. Understanding these landforms and how they are distributed helps in understanding where plants, animals, and natural communities occur. (Source: Vermont Biodiversity Project)



©R. Popp

distribution of species and natural communities in Vermont. For example, in the figure above, the red indicates cliffs, or slopes so steep that soil cannot accumulate there. Cliffs offer a habitat for a specialized group of plants that can survive with little soil and may provide denning habitat for bobcats.

This plant, *Saxifraga oppositifolia*, is one of several that make up the specialized Boreal Calcareous Cliff Community of Smugglers Notch. It can root in tiny cracks in the rock.

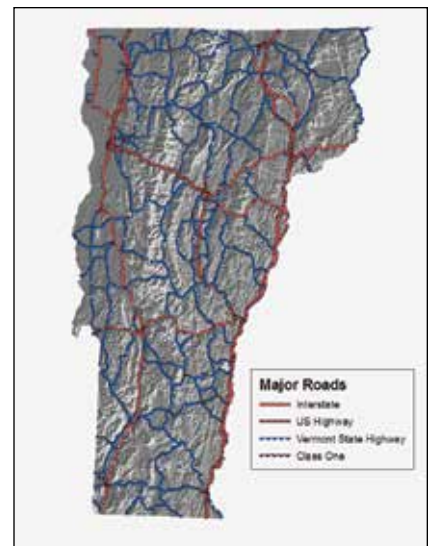
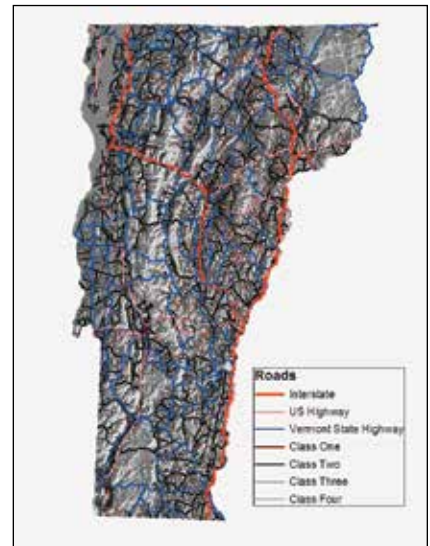
Hydrology

Water and its movement have a profound influence on animals, plants, natural communities, and ecosystem processes. Lakes, ponds, rivers, and streams provide habitat for a diversity of fish, aquatic plants, aquatic invertebrates, and other organisms. Wetlands form in waterlogged soils, either in lowlands where water collects by gravity, in uplands where impermeable soils create perched water tables, or at the highest elevations where fog and abundant rain provide a constant supply of water for wetland plants and animals. As noted in Chapter 3, wetlands and riparian areas provide a variety of habitat functions for wildlife along with other biodiversity values.

Land Use History

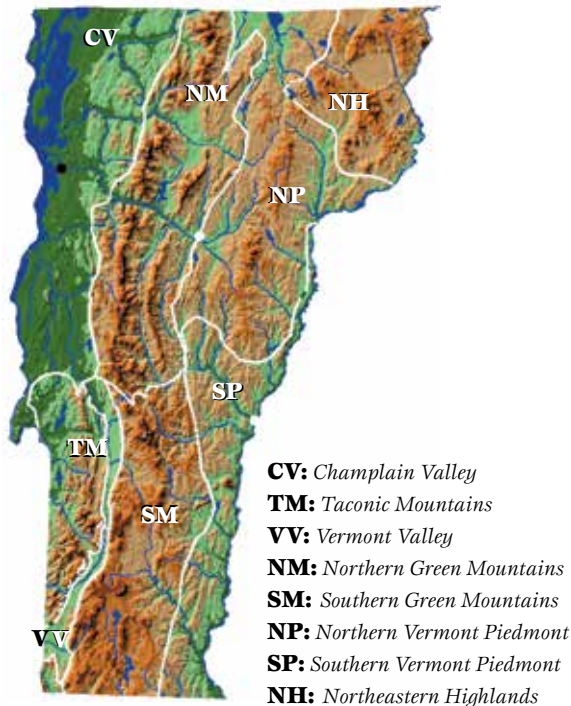
The final and often critical factor in determining the distribution of plants, animals, and natural communities is the history of land use. For instance, the degree and type of forest cover have a great influence on the species that occur in an area. Vermont has much more forest today than it had in the mid-1800s, and the effect of this change on wildlife has been dramatic. Today, Vermont's landscape is 78 % forested.

Vermont's agricultural activity also affected the soils and the plants that grow in them. During the clearing of the land in the 1800s, much natural topsoil was moved by erosion from the hillsides down to the low river valleys, the bottom of Lake Champlain, and even the Atlantic Ocean by way of the Connecticut River. It will take millennia for these soils to recover, and even today streams and rivers in Vermont still show the effects of the extensive land clearing of the 1800s. As Vermont's landscape recovers from past land uses, another major force that is transforming it again is commercial and residential development.



Maps 1-4 and 1-5 Fragmentation both statewide and within larger land units are delineated by major roads in Vermont.

Biophysical Regions of Vermont



Map 1-6 (Source: Vermont Biodiversity Project)

Biophysical Regions of Vermont

The six factors described previously were all considered in the classification of Vermont's eight distinct biophysical regions. It is important to consider Vermont's biophysical regions when assessing and planning for the conservation of natural heritage in a community. For example, what may be a common species in one biophysical region of Vermont may be rare in another, increasing the importance of conserving habitat for that species in the region in which it is rare. Vermont's eight biophysical regions are briefly described below.

Northeastern Highlands

Granite bedrock dominates this cool region, which is characterized by large wetlands, remote mountains, and lakes and ponds. Spruce and fir dominate the lowlands as well as the high elevations, whereas northern hardwoods cloak the mid-elevations. Forty-three percent of this region is conserved,¹ the highest percentage of any of Vermont's biophysical regions.

Northern Vermont Piedmont

Calcium-rich soils combine with a cool climate to support mixed forests and Northern White Cedar Swamps, Fens, and other interesting natural communities in this region. The uplands have fine agricultural soils, but a short growing season. Eight percent of the region is conserved.

Southern Vermont Piedmont

Calcium-rich soils and rolling hills make this a good place for agriculture. The climate is average for Vermont, except in the extreme southeast where it is quite warm. Northern hardwoods and red oak dominate the vegetation. Seven percent of the region is conserved.

Southern Green Mountains

A broad plateau is dotted with a few dominant peaks and several ski areas. Climate is cool and rainfall is relatively high. Northern hardwoods, spruce, and fir dominate, and there are a number of small lakes and ponds. Thirty-three percent of this region is conserved.

Northern Green Mountains

This area has a cool climate and high elevations and is mostly forested. Northern Hardwoods dominate the sideslopes, whereas high elevations have spruce and fir as well as Alpine Meadow communities. Twenty-six percent of the region is conserved.

Champlain Valley

This region of Vermont has a warm climate and abundant fertile farmland. The Champlain Valley contains both northern hardwood forest and also various species of oaks and hickory. It has some of the state's most significant natural diversity and also the state's most densely populated areas. Nine percent of the region is conserved.

Taconic Mountains

The slate belt of Vermont and New York is here. The Taconics are dramatic wooded hills dominated by sugar maple, beech, and yellow birch forests. Dry oak and hickory forests are found on the lower elevation knolls, while spruce and fir occur at the highest elevations. Ten percent of the region is conserved.

Vermont Valley

The Marble Valley has marble and limestone with glacial deposits on the valley walls, abundant springs, and wetlands. About 10 percent of the region is conserved.

Threats to Vermont's Natural Heritage



©LINDA LINDOW

Stone walls abound in the Vermont woods, a testament to the fervor with which settlers cleared the land and brought sheep to the hills in the 18th and 19th centuries. Nearly three-quarters of Vermont's forests were cleared by the middle of the 19th century.

This section provides a basic overview of the effects of land use and development on Vermont's fish and wildlife. It is intended to inform conservation practitioners of the broad and diverse ecological consequences of development. It is not expected that community, conservation, and other land use planners will be in a position to address all the issues presented herein. However, it is important, from a planning perspective, to understand the full spectrum of these issues.

Vermont's Landscape and Wildlife – An Historical Perspective

Vermont's landscape has long been altered by people. Native cultures grew crops, harvested animals for food and clothing and lived in established settlements. However, the clearing and development of the land increased markedly in the 17th and 18th centuries. By the mid-1800s 75 % of Vermont's forests were cleared for sheep farming agriculture and the production of timber products, especially for charcoal. Rivers and streams were choked with silt. Fish and wildlife populations were decimated largely due to habitat destruction and alteration as well as unregulated fishing and hunting, including killing wildlife as though they were pests or vermin. In this

period, even some common species such as beaver and deer nearly disappeared. When canals and railroads opened the Midwest in the mid-1800s, Vermonters left in droves, and the hills began to return to forest. Vermont is now approximately 80 % forest.

With the return of the forest and the recolonization and reintroduction of animal species, the beaver, deer, wild turkey, fisher, and other species that had declined have now returned in great numbers. This stands as a great testament to Vermont's commitment to wildlife conservation and the resiliency of the forests and wildlife. Many species of fauna and flora, however, have not recovered their populations either statewide or locally, and may never do so. For instance, the passenger pigeon is extinct and mountain lions and wolves, our top predators in Vermont, no longer roam this land.



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Vermont's Contemporary Land Use

Agriculture and forestry still support Vermont's economy in significant ways, but many areas of the state are now moving toward a service, commercial, and light industrial economy. The growing demand for residential and commercial building space appears to be driving a corresponding increase in the amount of land being developed to accommodate these needs. Is all of this development necessary? The Vermont Forum on Sprawl reports that the rate of development in Vermont is 2.5 times greater than the rate of population growth. Much of this development appears to be dispersed in rural and suburban areas rather than within existing village and urban communities, claiming land that supports fish, wildlife, and natural systems.

During the past two decades, Vermont's population has grown by 10%. As of 2010 the population was approximately 625,741 ("State and County Quick Facts"). During this same period, the number of automobiles registered in the state increased 20%, from 326,997 to 411,373 (Vermont Agency of Transportation, 2010). Vermont has seen a 40% reduction in the number of farms since 1960 (USDA Census of Agriculture). Between 1982 and 1992 Vermont lost 6,500 acres of open space each year to development, as reported in a recent report by the U.S. Environmental Protection Agency (1999). At the time of that report, the rate of open space loss was expected to increase.

In some parts of Vermont, new development patterns are typified by haphazard, and in some cases extensive, residential subdivisions and commercial strip developments. This type and rate of development has consumed parts of Vermont's forested and open landscapes that support many of the state's plants, animals, and habitats.

These development patterns reduce the average parcel size and alter the way people view their relationship to the land. The threat to a sustainable economy based on working landscapes is profound.



Residential development like this can cause fragmentation of forests and important habitat. (Source: "Above and Beyond," 2002)



Building upon existing town and village centers can help prevent or minimize impacts to wildlife habitat and provide more open space for public enjoyment of the natural environment. (Source: "Above and Beyond," 2002)

The Mechanisms of Loss

To better plan for natural heritage conservation, it is important to understand the effects of development. The following discussion explains seven major mechanisms by which current development patterns degrade Vermont's natural heritage:

1. direct loss of diversity;
2. destruction of habitat;
3. habitat fragmentation;
4. disruption of movement, migration, and behavior;
5. introduction of invasive exotic species;
6. degradation of water quality and aquatic habitat; and
7. loss of public appreciation for the environment.

Direct Loss of Diversity

As development alters natural habitats and ecological functions, the types and numbers of species change. Human activities, most notably land conversion, development, and pressures on our fish, wildlife, and natural resources have contributed to the listing of 153 species of plants and 42 species of animals in Vermont as state threatened or endangered. These species are protected by the Vermont Endangered Species Law (10 V.S.A. Chap. 123). The upland sandpiper, spotted turtle, spiny softshell turtle, common loon, beach pea, wild lupine, dwarf wedge mussel, small-footed bat, cobblestone tiger beetle, and eastern sand darter, among many others, are all affected by human development and activities in spite of laws protecting them. In addition, there are many more species of plants and animals that

are considered rare or uncommon in Vermont, yet lack the protection of the Endangered Species Law. These include the Jefferson salamander, least bittern, pied-billed grebe, rock shrew, and great St. John's-wort. Every year, habitats for these rare and uncommon species are lost to development.

Like plant and animal species, whole natural communities can be lost to or negatively affected by human development.

Natural communities are defined as interacting assemblages of organisms, their physical environment, and the natural processes that affect them (Thompson and Sorenson, 2000). Vermont has 80 types of upland and wetland natural communities including northern hardwood forest, alder swamp, and hemlock forest. Some of these communities are rare and highly sensitive to human disturbance and development. Examples include Valley Clayplain Forest, Alpine Meadow, and Pine-Oak-Heath Sandplain Forest.

Pine-Oak-Heath Sandplain Forest is one of the most dramatic examples of an imperiled community. Of its original 15,000 acres, only about 750 acres, or 5%, remain today. The majority is located in the urban and suburban areas of Burlington, South Burlington, Essex, and Colchester. The largest

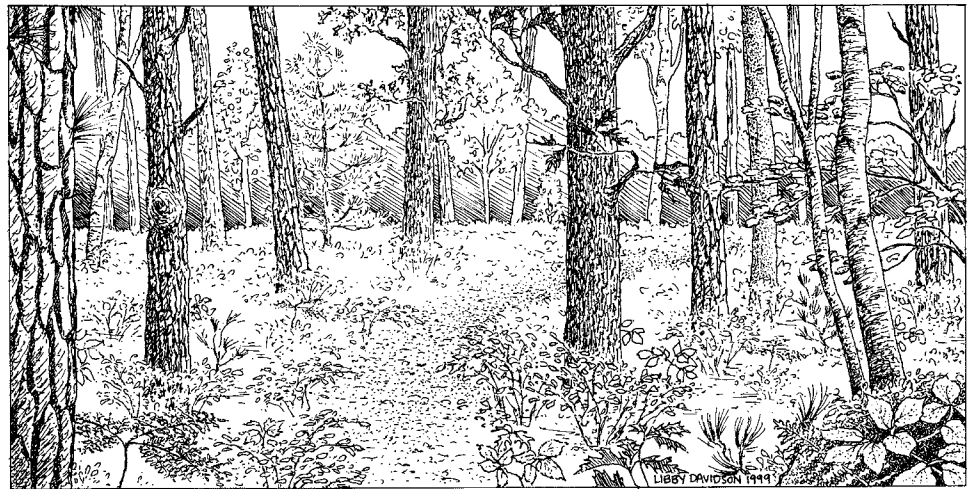


Fig. 1-4 Pine-Oak-Heath Sandplain Forest has been reduced to a fraction of its original extent. (Source: Libby Davidson, "Wetland, Woodland, Wildland")

remaining Pine-Oak-Heath Sandplain Forest, located at Camp Johnson in Colchester, is approximately 250 acres in size. Only one other site is larger than 100 acres. As the size and abundance of natural communities are reduced, species restricted to the community often become rare or disappear altogether. There are 35 rare plants found in Pine-Oak-Heath Sandplain Forests, nine of which are on the state's list of threatened and endangered species. Development continues to threaten our remaining Pine-Oak-Heath Sandplain Forests as well as other rare and sensitive natural communities. More common natural communities such as Northern Hardwood Forests are well-represented in the state, but reduction in their size and loss of connectivity between them still threatens their function as habitat for fish and wildlife.

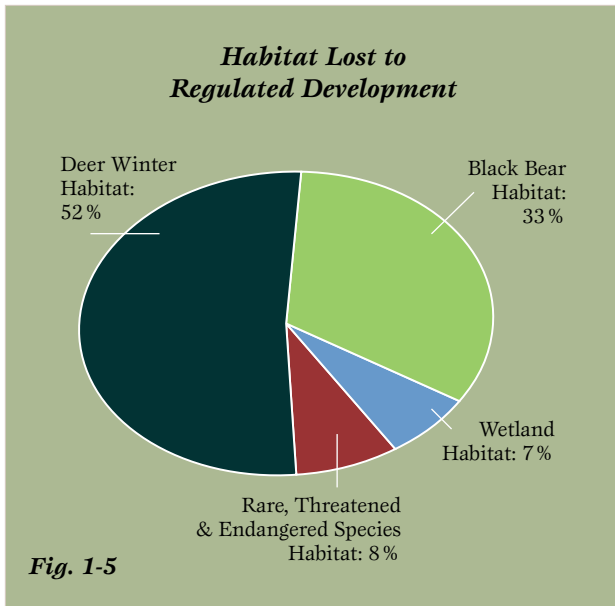
Destruction of Habitat

As buildings, parking lots, roads, and lawns replace the natural vegetation of Vermont's landscape, we lose significant wildlife habitats, such as deer winter habitat, wetlands, habitat for threatened and endangered species, and feeding and denning habitats for black bears. Loss of habitat from development is almost always permanent. The Vermont Fish and Wildlife Department works diligently through regulatory and non-regulatory programs to protect and conserve important wildlife habitats, but local communities and individuals need to share the responsibility for protecting and conserving these habitats in order for them to persist.



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The black racer snake is protected by the Vermont Endangered Species Law, but is still affected by human development.



During the period 2005 through 2011, state regulated development alone has cost Vermont at least 4,000 acres of significant wildlife habitat and 120 acres of endangered species habitat, or about 525 acres annually, roughly the area of the City of Rutland. This figure, however, is conservative. It does not include development unregulated by state government, nor does it include habitats that don't fit the definition of "necessary wildlife habitat" as defined by Act 250.

Habitat Fragmentation

One consequence of human settlement of the landscape is the fragmentation of habitat into smaller and smaller areas. The creation of gaps in the forest and barriers to wildlife movement, such as housing and commercial development, roads, and power lines, results in the direct loss or inaccessibility of important



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Fig. 1-6 *Fragmented forest canopy plus roads and house sites have an impact on the native plants and animal communities of this hillside. (Source: "Above and Beyond," 2002)*

habitat. The reduction in size of forest patches by roads and associated development can render the forest and other habitats unsuitable for certain species of native plants and animals. The smaller the habitat patch, the smaller the number of species that can occupy that habitat (MacArthur and Wilson, 1967). Fragmentation of a forested area affects species composition, favoring species like raccoons that are tolerant of human activities and more general in their habitat requirements. These tolerant species often include invasive exotic plants and animals that out-compete native species or otherwise lead to decreased productivity of native species. Fragmentation can lead to reduced populations of plants and animals as a result of predation pressure along forest edges. In forested natural communities, fragmentation can lead to increased species vulnerability to natural disturbances. Fragmentation disrupts natural connections between habitats that are essential for

Habitat Fragmentation

Habitat fragmentation directly affects our resident and migratory songbirds. Vermonters' lives are enhanced by the colorful presence and songs of birds like the northern oriole, hermit thrush, and American redstart. However, many of our native songbird populations are declining because of the brown-headed cowbird. Rather than building their own nests, brown-headed cowbirds lay their eggs in the nests of other songbirds. Typically, the young cowbirds out-compete the host birds' offspring, reducing the number of native migrant songbird young that survive to maturity.



Cowbirds, though native to the United States, are not native to the Northeast. Having evolved in the prairies of the Midwest, they thrive in the kind of edge habitat that is created when a forested landscape is developed and fragmented. This is just one dramatic illustration of how some development results in the loss of rich species diversity, eroding the quality of life in Vermont.

the movement, and ultimately the survival, of many species of large, wide-ranging carnivores such as black bears, bobcats, and fishers. Even small mammals such as mice and shrews are adverse to crossing roads or paths just a few feet wide.

Disruption of Movement, Migration, and Behavior

In the last quarter of the 20th century, Vermont expanded its road system by an average of 26 miles per year to a total of about 14,251 miles. As previously mentioned, the number of non-commercial vehicles in use has increased dramatically in Vermont, reflecting the dispersed development, or sprawl, that requires people to travel more often and longer distances to work, shop, and recreate.

The number of vehicle miles traveled by Vermont residents is growing at seven times the rate of population growth, according to information from the Vermont Agency of Transportation as reported by the Vermont Forum on Sprawl. (“Exploring,” 1999). A growing Vermont population is continuing to spend more time driving.

What do more roads and traffic mean for fish and wildlife? First, vehicles pose a direct threat to wildlife. In Vermont alone, motor vehicles kill nearly 2,500 deer and moose annually. Collisions with such large animals present a real threat to people as well as animals.

Second, roads fragment habitat and affect the movement of wildlife ranging from salamanders and fish to black bears. The type of road and the volume and type of traffic play important roles in determining the impacts on wildlife. High traffic volumes may prevent bears and bobcats from using traditional

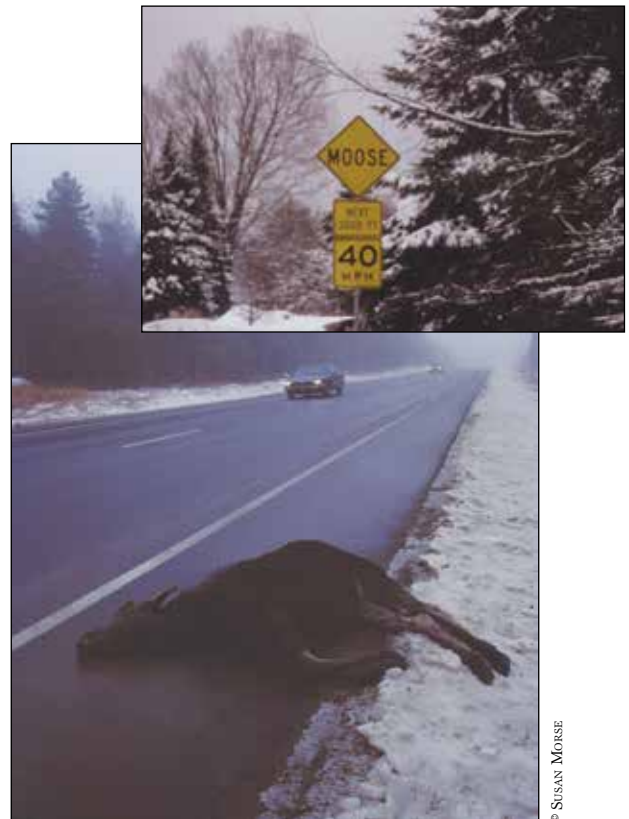


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Culverts can help animals to move across roads by providing passage under the road. But when they are too small and have no dry ground to travel on, as in this photo, few animals will use them. In addition, improperly sized or placed culverts can prevent the movement of fish and other aquatic organisms that were able to move freely before.

movement corridors that allow access to important habitats. Traffic noise prevents some songbirds and marsh-nesting birds from locating mates and discourages nesting and the rearing of young in traditional reproductive habitat.

Secondary effects of inhibiting natural movement of plants and animals can include an ultimate reduction in population size. For example, roads can isolate populations of black bears by preventing or limiting their movement to portions of their range, thus limiting their opportunities for finding mates, reproducing, and even exchanging genetic material. For some species, reduction in genetic variability results in inbreeding depression, wherein reproductive rates, offspring survival and, ultimately, population size are all reduced. Small, inadequate, or poorly placed culverts create barriers to fish migration in streams, preventing access to vital spawning areas and cold-water summer habitat. Culverts can also block passage of terrestrial wildlife that use stream sides as habitat or travel corridors. Today, Vermont has 900 culverts on the state highway system alone, and many more uncounted culverts on town and city roads, as well as private driveways.



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Roads can present a sometimes fatal barrier to animal movement.

Introduction of Invasive Exotic Species

Imagine a marsh, once home to hundreds of different species of plants, now dominated by a single invasive exotic species. This scenario becomes reality as purple loosestrife and goutweed move across our landscape. “Exotic” species are those introduced, either deliberately or accidentally, into an ecosystem or geographic range where they do not naturally occur. Invasive exotic species are ones that proliferate, aggressively displace other species, and even alter natural communities. Once an exotic invasive species becomes established, it literally takes over the whole area it invades.

Examples of invasive exotic plant species in Vermont are Eurasian watermilfoil, purple loosestrife (shown below), common buckthorn, Japanese knotweed, Morrow’s honeysuckle, goutweed, and black swallow-wort. All of these species are highly invasive and can alter the native flora and fauna of a natural community, changing the biological mix and diversity. Unfortunately, invasive plants are still widely used for landscaping in housing and commercial developments, individual house sites, and travel ways. Many invasive species are effective colonizers of abandoned farm land or any site where the soil has been disturbed. These species, for example, spread immediately after construction.

Examples of invasive exotic animals include zebra mussel (shown right) and mute swan. Zebra mussels, now well established in Lake Champlain, can cover and kill native mussels and cause damage to water lines, underwater archeological sites, docks, and boats.



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Degradation of Water Quality and Aquatic Habitat

Changes in land use have several cumulative impacts that affect water quality and, consequently, fish and other aquatic life.

Erosion of Exposed Soil —

Soil erosion is a significant factor influencing water quality in Vermont. When soil from a tilled field, construction site, gravel road, poorly-constructed woods road, or severely eroding streambank reaches a stream it often results in negative effects on water quality and aquatic habitats. Siltation of stream bottoms can destroy the habitats of stream invertebrates, an important part of the aquatic food web, and suffocate incubating eggs and young of many fish species. Increased silt loads in streams can also absorb more solar radiation, increasing stream temperatures which reduces oxygen levels in the water, thereby reducing habitat quality for cold-water species such as brook trout. Silt-laden waters may also reduce the feeding efficiency of many fish species, thereby reducing individuals’ fitness and survival. Eroded soils can contain toxic materials such as pesticides and petroleum products associated with construction, logging, agriculture, or vehicle traffic on a gravel road. Even excess nutrients, such as phosphorous, in soils and in overland runoff can pollute streams and lakes, causing algal blooms, reduced oxygen levels and, in severe cases, fish kills.

Runoff from Impervious Surfaces —

Water flows through most naturally occurring soil types, but road surfaces (paved and gravel) are impervious to water. As more roads, driveways, parking lots, homes, and commercial buildings are built, the increase in land area covered by impervious surface area in a watershed leads to a number of negative effects on the entire watershed.

Studies show that stream stability and biological integrity are significantly compromised when more than 10% of a watershed is covered with impervious surfaces (Schueler, 1994). With increased impervious surface area, runoff from storms and snowmelt enters streams, rivers, lakes, and other water bodies more quickly. This reduces the amount of filtration and obstruction that vegetation and soils naturally provide. Filtration and obstruction are critical in removing sediments, heavy metals, pathogens, pesticides, and excessive nutrients from surface flow before it reaches water bodies.



Paved surfaces are impervious to water, so they cause water to move directly into streams with none of the natural filtering that soil and vegetation provides.

Impervious surfaces also absorb heat from the sun faster than natural ground covers. Runoff traveling over impervious surfaces picks up this heat and transfers the higher temperatures to water bodies. Higher water temperature results in thermal stress on fish and other aquatic life, reducing health and productivity and, in extreme cases, causing death.

Changes in Stream Shape and Flow —

Development affects the hydrology of a watershed in many ways. Roads built along riverbanks can effectively “trap” that river in its current channel, preventing its natural meandering and causing it to cut a deeper channel, changing flow and sedimentation rates. Clearing and development can change the quality, quantity, and timing of water running from the land into our lakes, rivers, and streams. Impervious surfaces, road and yard drainage systems, and stream and river channel alterations all increase the volume of runoff that enters a water body over time. This has several negative effects on fish and other aquatic life.

For instance, spring high flows can occur earlier in the year, often with greater intensity and shorter duration. This shift in a watershed’s hydrology can disrupt migrations, spawning cycles, food availability, and seasonal water temperatures. Additionally, seasonal flooding can increase in both magnitude and frequency. Natural flooding is an important process in stream and river ecosystems; however, larger and more frequent floods can cause prolonged channel destabilization that leads to degradation of aquatic habitat.

Loss of Public Appreciation for the Environment

What is the result of people moving into wildlife habitat? As communities become more suburban and urban, people tend to have fewer positive experiences with wildlife. Animals are seen more as a nuisance than an integral part of our quality of life. Deer are no longer considered a valued product of the land to be enjoyed by many interests, but pests who eat ornamental shrubs and flowers. Canada geese damage golf course property. Flocks of gulls cause concern at airports. Raccoons roam suburban neighborhoods tipping over garbage cans. Squirrels can take up residence in attics and damage electrical wires. When these or other wild animals disrupt human habitat they are often viewed as pests.

Aldo Leopold, one of the founders of modern wildlife management, wrote, “[T]here are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace.” Unfortunately, as people become more accepting of a human-developed landscape, they can lose their connection with the land and their appreciation for wildlife and its importance.



Natural flooding is an important process in stream and river ecosystems. However, larger and more frequent floods caused by land clearing or channel alterations can cause prolonged channel destabilization that leads to degradation of aquatic habitat.

What Vermonters say about the state's natural heritage

What is it about your life in Vermont that you value most?

- ▶ The wildlife, woods, animals, etc.; simply, it's a beautiful place to live.
- ▶ Low population; open land; and good hunting and fishing.
- ▶ Quiet beauty everywhere in woodlands and streams.
- ▶ Opportunity to live in and interact with the natural world.
- ▶ Our woods and waters with its abundant wildlife...our farms and their open fields.
- ▶ The ability to walk, snowshoe, canoe, and x-country ski in beautiful, natural areas without being near houses or noise.

What is it about Vermont that you would like to see passed on to your grandchildren?

- ▶ To love wildlife and be able to be a part of it first hand.
- ▶ Lots of open land.
- ▶ Clean air; clean, cold water; well-managed wildlife habitat, and public access to enjoy it.
- ▶ The sustainability of our farms and rural nature of most of our counties.
- ▶ Vermont lands, forests, and waters preserved for wildlife and quiet outings, as well as ways of making a living through agricultural means.
- ▶ The privilege to hunt and fish.
- ▶ The wild areas.

What threatens the future you desire for your grandchildren?

- ▶ Development and urban sprawl.
- ▶ Overpopulation and urbanization of every area of the state.
- ▶ Lack of opportunity to make a living on the land.
- ▶ Lack of knowledge among urban population of the benefits and responsibilities associated with wildlife habitat conservation.
- ▶ Too many people; sprawl; progress without planning.
- ▶ Developments taking over prime agricultural areas, water pollution.
- ▶ Loss of working landscape and land conversion to second home developments, strip malls, etc.
- ▶ Lack of respect and recognized value for the land and wild places.

As Vermont's population has grown, the number of Vermonters who hunt, trap, and fish has decreased. On the other hand, more passive wildlife appreciation – bird watching, hiking, and nature study – has increased. This encouraging information demonstrates a strong need for Vermont communities to plan for the conservation of fish, wildlife, and natural resources.

A 1996 survey conducted for the Vermont Fish and Wildlife Department provides encouraging statistics:

- ▶ 87 % of Vermonters support the Department's use of regulatory mechanisms to protect wildlife habitat.
- ▶ 94 % of Vermonters support the Department's efforts to work with town and regional planning commissions to include plants, animals, and habitats in planning development.

Although public appreciation for wildlife may seem to be eroding by some measures, most Vermonters still care about wildlife and natural resources. The following chapters in this guide will help develop the tools Vermont can use to conserve this heritage.

Can we afford to take land off the tax rolls?

One of the concerns citizens have about conserving land is that it will raise property taxes in town. There are really two questions:

1. When a parcel is taken off the tax rolls, the taxes it would normally pay are shifted to other taxpayers in town. How much is the increase?

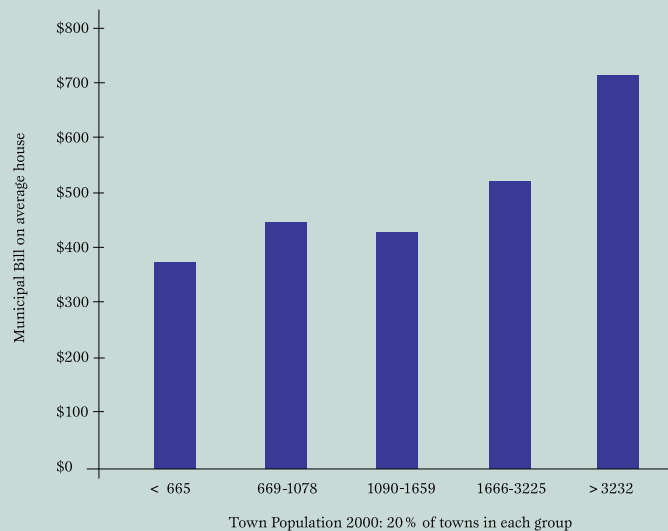
This can and should be calculated. Most people are surprised to find that, since the passage of Act 60, taking land off the tax rolls does not affect school tax rates, except in the first year.¹ And, since roughly 70 % of the property tax bill is for schools, this means that only about 30 % of the taxes normally paid on the property would be shifted to other taxpayers in town. In addition, there are often payments made by state or federal governments to offset tax loss. Finally, in the case of a conservation easement, only a portion of the value, if any, is removed from the tax rolls.

2. In the long term, will taxes be higher because that parcel can't be developed?

Because developed property generally pays more in taxes, there is the perception that taxes are lower in towns that have more development. However, developed property also costs the town more to serve. In Vermont, on average, the municipal property tax bill on the average-value house is higher in towns that:

- ~ Have the most year-round residents;
- ~ Have the largest tax bases, and/or
- ~ Have the most commercial and industrial taxable property.²

The tax question is important to consider, but it is only one factor to weigh in answering the ultimate question: ***What is best for the town?***



¹ For more information on Act 60 and land conservation, see the Act 60 Appendix of the report: “The Land Use-Property Tax Connection.” 2002. Vermont Natural Resources Council and the Vermont League of Cities and Towns.

² For more information on the relationship between land use and property taxes in Vermont towns, see “The Land Use-Property Tax Connection.” 2002. Vermont Natural Resources Council and the Vermont League of Cities and Towns.

Prepared by Debra Brighton

CHAPTER 2



Conservation Planning



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To better understand the needs and interests of Vermont communities for conservation planning, the Vermont Fish and Wildlife Department hosted a “Focus Group” meeting with a variety of local and regional planners, government, and non-government organizations. Results from this meeting indicated a great degree of dedication, interest, and enthusiasm for improving Vermont’s ability to protect and conserve the state’s natural heritage and rural way of life.

Status of Vermont's Conservation Planning

In 2010, Vermont Natural Resources Council and the Vermont Fish and Wildlife Department (VFWD) conducted an evaluation of all existing town plans in the state to determine how well town plans and zoning addressed or considered fish and wildlife issues and interests. Results from this evaluation are detailed in a report entitled *Fish and Wildlife Considerations in Local Planning: A Vermont Review*. The results are enlightening. First, 248 of Vermont's towns have plans. Of these 248 town plans, 99% of them identified wildlife and/or fish habitat as an important public resource. Here are some other interesting statistics taken from the report:

- ▶ 91% of plans included mapped data.
- ▶ 87% recommended the protection of wildlife habitat
- ▶ 86% of plans included natural resource inventory data.
- ▶ 83% identified the public benefits associated with wildlife habitat protection.
- ▶ 38% of towns have conservation commissions, an indication of a community's conservation interest.

Interestingly, 81% of town plans discussed fish and wildlife and their habitats in a broad ecological context. This is encouraging. In addition, an overwhelming majority of the plans recommended regulatory and/or non-regulatory mechanisms

for protecting and conserving fish and wildlife habitat. But few plans that articulated the need for habitat protection and conservation strategies actually translated these goals into specific zoning or subdivision policies for conserving wildlife habitat.

To better understand the needs and interests of Vermont communities for conservation planning, the Vermont Fish and Wildlife Department hosted a "Focus Group" meeting with a variety of local and regional planners, government, and non-government organizations. Results from this meeting clearly indicate a great degree of dedication, interest, and enthusiasm for improving Vermont's ability to protect and conserve the state's natural heritage and rural way of life. Recurring issues from the results show several things. First, better and more readily available information on fish, wildlife, habitat, and overall biological diversity is needed. Second, more funding is needed to conduct species and habitat inventories, educate the public (particularly youth) on conservation issues and interests, and acquire important lands for conservation purposes. And third, there is a lack of good land use planning due to a lack of information about how to do it.

We hope this book will help to fill the information gaps by providing detailed information on natural resources, as well as guidance on how to incorporate Vermont's natural heritage into conservation planning.



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Eighty-four percent of the town plans recommended regulatory and/or non-regulatory mechanisms for protecting and conserving fish and wildlife habitat.

Conservation: The Planning Process



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The greatest challenge in conservation planning is to translate the habitat conservation goals articulated in town plans into effective zoning bylaws, land acquisition funds, and other conservation strategies.

Conservation planning is a process by which a group of people considers the current status of an area (for example, a town, a watershed, or a region) with respect to its development, growth, and natural environment, and identifies the most effective mechanisms for conserving its natural heritage – its ecosystems, fish, wildlife, plants, habitats, natural communities, and the public’s interests therein. (See the fictional case study in Chapter 6.) The process considers the public’s interests in our natural heritage and obligations to future generations. Through conservation planning, the rural culture and character of Vermont can be maintained along with its natural heritage. This manual presents choices and ideas for incorporating fish, wildlife, and other natural heritage elements into land use and conservation planning, but it should be kept in mind that there may be other approaches that would also be suitable for this purpose.

Though designed to be used at the town level, the process we describe can just as easily be used on a larger or smaller scale. It can be used to plan for a single parcel of land, a group of adjoining parcels, a watershed, a group of adjoining towns, a county or other planning region, a biophysical region, or a larger area.

It is assumed that the reader is a landowner, a town or regional planner, or a representative of an organization or agency that is interested in conserving fish, wildlife, plants, and the overall natural heritage in a particular area, large or small. The following

steps apply to all users of this information but should be adapted to meet specific needs of a particular organization or project.

Some towns and cities have hired natural resource professionals to develop local conservation plans using a model similar to the one described here. Such professional assistance can be very helpful in making sure the information is complete and that all opinions are heard.

Conservation planning has four steps, which are described briefly below and in more detail in Chapter 6.

Step One: Setting Vision and Goals

Start with forming a conservation vision and setting goals. This should involve all interested parties, which include all residents and regular visitors to the area. Begin by asking some questions: Why do you live or visit here? What is it you appreciate about this place? What do you want the town (or region) to look like in 20 years? In 50 years? In 100 years?

Once participants have agreed on a vision, it is possible to begin drafting some clear conservation goals. What specific things will contribute to the vision? It is important to note that this part of the process may be revisited based on an analysis of the information considered in Step 2. As you come to understand the current conservation status of an area, your planning vision will change. This process should be flexible so you can make adjustments based on what is learned from the information and data you gather.

Step Two: Gathering and Interpreting Information

This step involves compiling existing information on the natural resources of the local area of interest, as well as a larger geographical area. Find out where important resources are locally, but also assess how they fit into the larger regional context. Look especially at the entire biophysical region that includes your local area. Work with surrounding communities to coordinate the information gathering and assessment.

Step 2A. Gather Existing Data

Gather all the existing natural resource information for your town or area of interest. There are two kinds of data: digital data, information that can be viewed on and analyzed by a computer, and *manual data*, information you find on paper maps, in reports, and on photographs. We recommend using both together if you have the technical expertise and equipment. (The Appendix contains information on how and where to obtain existing digital and manual data, as well as how to get help in interpreting it.)

Geographic Information Systems (GIS), ArcView, and ArcGIS

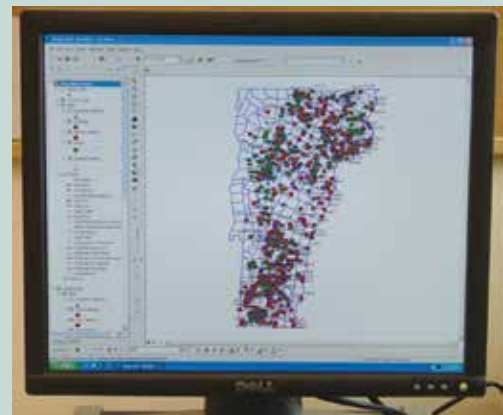
Throughout this manual we refer to GIS, ArcView, ArcGIS, and other related computer tools that help in managing digital geographic data. Although planners have done excellent work without these tools for a long time, GIS is quickly becoming the standard for keeping track of large amounts of geographical data and helping to look at multiple pieces of information at once. In the last few years, these applications have begun to provide non-technical users the means to directly access sophisticated spatial analysis and mapping tools.

► **GIS** stands for “geographic information systems”. It is a catch-all term for the many software programs and systems that manage geographic information. ArcView and the more comprehensive ArcGIS (made by Environmental Systems Research Institute – ESRI) are commonly used software programs that help users see many data layers at once.

In some ways, GIS works just like mylar overlays. One can look at several different maps at once and can remove or add maps as needed. In other ways, it is much more sophisticated than a set of mylar maps because the software not only makes maps with multiple sets of information, but also provides tools to analyze that information.

The different sets of information are called data layers or themes. As an example, a town may wish to look at wetlands and forest cover. Using ArcView software, the planner can open a wetlands theme and a land cover theme, and perhaps overlay these on a roads theme. This allows the planner to see where forested wetlands occur and how close they are to roads. In addition, the planner can ask such questions as “what is the total acreage of forested wetland?” or, “how many wetlands are within 500 feet of a road?” and get almost instant answers.

A helpful publication that explains GIS basics (*GIS: Helping Vermonters Visualize Choice*) is available at the VCGI web page (www.vcgi.vermont.gov).

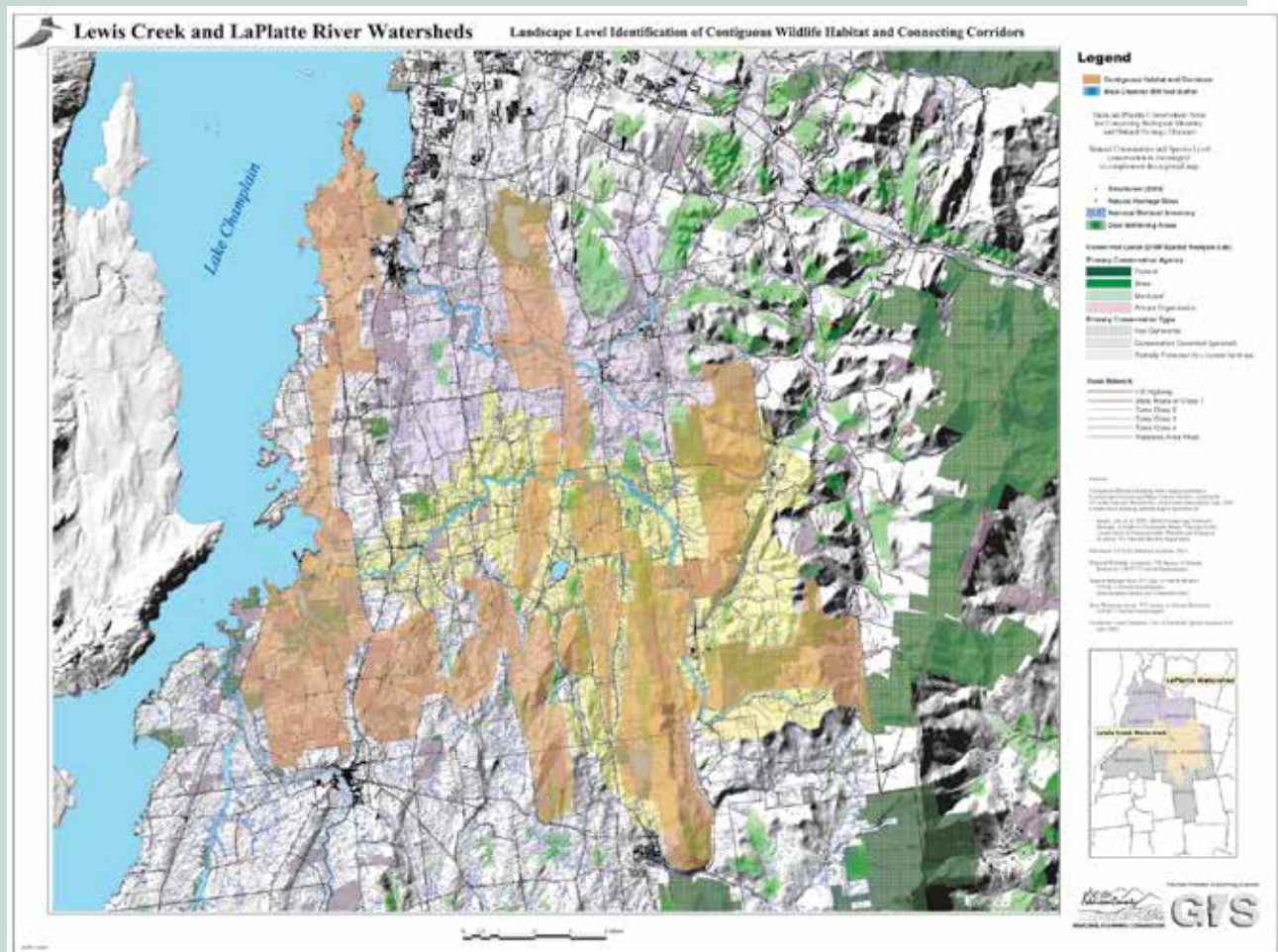


ArcView screens showing wetlands and forest for Ridgeville.

Lewis Creek Association — A Study in Cooperation

The Lewis Creek Association (LCA) has effectively solicited and applied the assistance and knowledge of local residents within several towns that compose the Lewis Creek watershed. By evaluating natural resources, particularly wildlife, on a watershed scale, and using the knowledge of area hunters, anglers, trappers, hikers, and wildlife enthusiasts, the LCA was able to identify

important wildlife habitats, wildlife corridors, riparian zones, and other unique lands that were important to the communities within the watershed. The LCA serves as a marvelous example of cooperative conservation planning by multiple towns at an effective scale (watershed) that places great value on the knowledge and interests of the community residents.



Digital data are found mainly in the form of data layers, which when viewed in GIS look like maps on a screen. The advantage to these kinds of data is that they can be manipulated and combined with other data sets easily. Regional planning commissions can assist you in gathering digital data layers and can help you in interpreting them. You may also want to hire a GIS professional to gather the data layers and put them into an easily accessible format. Many of the data layers useful in conservation planning can be obtained from the Vermont Center for Geographic Information.

Regional planning commissions (RPCs) are typically the developers and repositories of detailed GIS data for each town in their region because most towns in Vermont do not maintain full-time GIS or planning professionals. The commissions adhere to the GIS standards and guidelines for creating, maintaining, and documenting geographic data. RPCs can provide technical assistance as well as helping in obtaining the geographical data. The Vermont Center for Geographic Information (VCGI) also stores and distributes many statewide GIS data sets, including some uploaded for distribution by regional planning commissions. But typically the Center does not store and distribute all the detailed GIS data sets available at an RPC. Town planners are advised to consult their regional planning commissions for advice and assistance with GIS data.

Manual data include paper maps, aerial photographs, site reports, historical information, and anecdotal information provided by local residents. The Vermont Fish and Wildlife Department offers a great deal of information on the landscape, community, and species elements of our natural heritage across the state. A conservation group preparing to engage in planning should contact the Department for baseline information. It is also useful to include data from the program “Keeping Track,” colleges and universities, federal agencies, regional planning commissions, local and regional conservation groups, and local experts. Residents who hunt, fish, trap, or regularly view and photograph wildlife are excellent sources of valuable information on animal movements and the location of important habitats.

The Appendix contains information on how and where to obtain existing digital and manual data, as well as how to get help in interpreting it.

Gather all available data and information and store it in a central location that can be accessed by all participating planners. Your information should be in two complementary forms: *maps* and a *database*. The maps will show where things are in your landscape, while the database will provide more details on

each of the elements that are mapped. Here’s an example of a manual map. But the same information can be shown on a digital map.



The important thing, whether you use manual maps or digital maps, is that

you have a database of information that explains what you are displaying on your maps. Otherwise the maps are not very useful for planning.

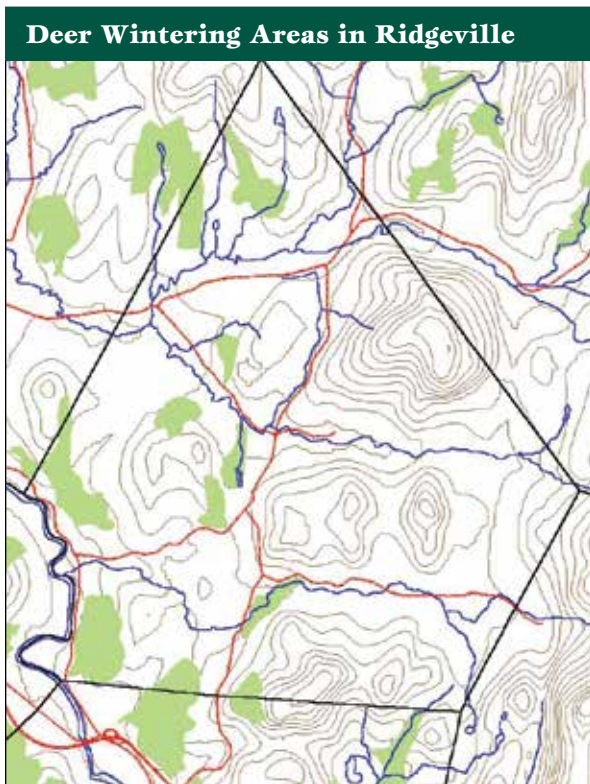
Finally, prepare a set of maps and database reports for display and discussion by the planning group. It is important to display the information in a way that makes it clear and easy to read. Many towns and other planning groups have a map and data specialist — either paid or volunteer — who is charged with making all the maps and presenting the accompanying data. Whether you are using paper maps or digital maps, you will probably need several different maps of your town or study area to show all the features of interest. In either case, keep it simple but accurate!

Step 2B. Gather New Field Data

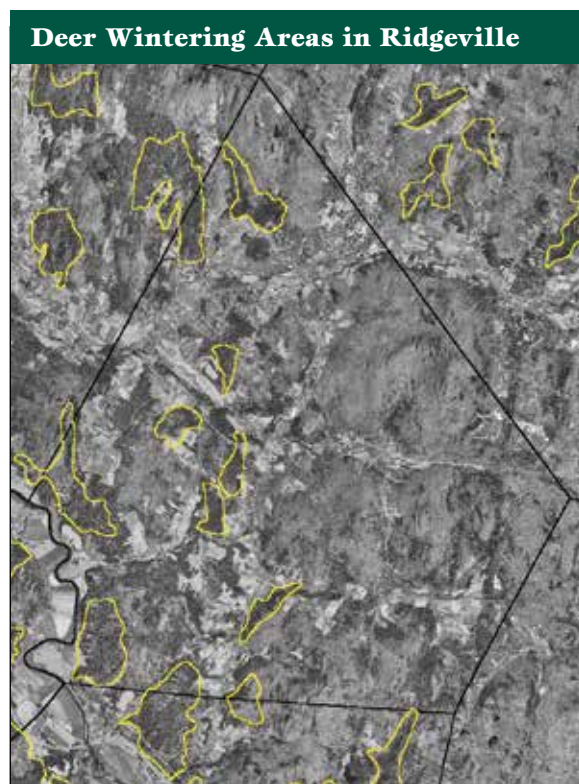
To develop the most effective conservation plan possible, it is essential to gather new field data in addition to using existing information. For example, the deer wintering area (DWA) shown right was identified from aerial photographs in the 1960s and 1970s. New field data would help planners decide how to conserve this area. Is the area still functioning as a DWA? Is it mapped accurately? Are there current threats to it? These questions can be most effectively answered by a field inventory.

Some kinds of field data are easily gathered by volunteers with minimal professional guidance. Other information is best gathered by or under the

close supervision of a natural resource professional, which may require an expenditure of money and time. Towns should start by giving a priority to each piece of new information they need and then begin the process of pulling it together. Even if it takes several years to get the new information, it is a worthwhile effort. The reward is better planning in the future. In the meantime, use the information at hand to make the best conservation planning decisions you can, and update your data set as you go along. In the following chapters, we describe how new field data are gathered for each of the natural heritage elements.



Map 2-1 GIS Map of Deer Wintering Areas. (Source: Vermont Fish & Wildlife Department Everett Marshall)



Map 2-2 GIS Map of Deer Wintering Areas in Ridgeville with ortho photography. (Source: Vermont Fish and Wildlife Department – Everett Marshall and Kevin Viani)

Step Three: Develop Conservation Strategies

With a vision and goals articulated and the data gathered for each heritage element involved, the planners then develop a set of strategies for achieving their goals. First, this is done by identifying priority areas or features within each heritage element that is being considered. Are all the examples of the element in your area of interest equally important, or are there more important and less important examples within the area? What is the threshold that separates the more and less important? Strategies for each natural heritage element are described in detail in Chapters 3 through 5 that can help you answer these questions.

Planning for conservation often involves considering more than one resource at a time. This can be intimidating because it deals with setting multiple priorities at once and selecting the “most important” areas or features of different heritage elements to be brought in together for a single conservation strategy. This book lays out heritage elements at landscape, community and species level scales. It is often helpful to combine important areas from each of these separate spatial scales. Keeping these scales separate can be useful since different regulatory standards or non-regulatory tools will be more or less useful at different spatial scales.

Prioritization of different resources at different scales is a key part of the planning process. Once your group or commission has identified priorities at different scales, you can begin to overlap them and identify areas that include multiple priorities from various scales and different elements. These places may be important areas for increased landowner education or technical assistance or willing-owner easements or management agreements. This could be appropriate action for a conservation commission. Adapting the separate scale-priorities into a tiered priorities map may be appropriate action for a planning commission that would adopt separate standards for the different scales (See the Case Study on Page 111). In either example, it is necessary to come to terms with the junction of ecological priorities and your community’s values.

In Chapter 6, the citizens and planners in the fictitious town of Ridgeville go through the planning process, showing how to bring together multiple strategies for all the natural heritage elements to achieve their overall vision and goals.

Step Four: Implement Conservation Strategies

Finally, planners must find ways to make their strategies work in the real world. Chapter 7 describes a number of techniques, from adopting town plans to participating in Act 250 reviews, that citizens and town officials can use to implement their conservation strategies.

PART II

Natural Heritage Elements





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The conservation of large landscape areas and connections between them help support a variety of plants and animals.

Natural Heritage Elements

The elements of our natural heritage — all the things that are important to consider when planning for conservation — range from individual species and their particular habitat needs to large landscapes and the many species and ecological functions they support. We have a reasonable knowledge of the habitat needs of some species, like black bear and peregrine falcon, but for most species there are major gaps in our knowledge. Very little is known, for example, about most invertebrates, fungi, and bacteria, yet all of these are crucial to the healthy functioning of our ecosystems.

Because we know these organisms are important but cannot conserve them species by species, we use surrogates (other measures that can substitute for specific knowledge of species). One of these surrogates is the natural community. Conservation biologists estimate that if we protect, conserve and/or properly steward multiple examples of all natural communities, we will retain 80 to 90 percent of all native species. As an example, if we provide stewardship for or

protect riparian areas, fish and other aquatic organisms will be assured of quality habitat, terrestrial wildlife will have habitat in which to migrate and feed, and humans will have beautiful lakes and streams to enjoy.

But conserving natural communities and other surrogate features (such as large-scale habitats like bear feeding areas) in isolation is not enough. To ensure the proper functioning of these communities and to provide habitat for wide-ranging and reclusive species, we must conserve and foster the stewardship of large landscapes (large areas of undeveloped land) with all their component species, habitats, and natural communities. In general, conservation at the landscape level can be an effective approach for simultaneously protecting multiple species and natural community elements. In addition, focusing conservation planning efforts on these elements will effectively address many of the public interests associated with the natural environment, ranging from hiking to wildlife watching to fishing.

The following chapters cover three conservation levels. Each level contains several individual elements.

Landscape Level — These elements represent a diversity of landscapes and also address the conservation requirements of species that have large ranges, that need large forest areas, or that need specific kinds of physical settings:

- ▶ contiguous forest;
- ▶ connecting lands; and
- ▶ enduring features.

Community Level — These elements comprise groups of species and their physical settings and are especially useful in conserving many natural resource values simultaneously:

- ▶ natural communities;
- ▶ wetlands;
- ▶ riparian areas and aquatic features; and
- ▶ vernal pools.

Species Level — These elements require special attention because we cannot be assured of capturing them through landscape-level or community-level conservation:

- ▶ rare, threatened, and endangered species;
- ▶ deer winter habitat;
- ▶ mast stands;
- ▶ important bat habitats;
- ▶ important turtle habitats;
- ▶ grassland bird habitat; and
- ▶ early successional forest and shrub habitats.

Each of these element sections follows the same outline:

Definition: A brief definition of the element.

Importance: Why the element is important to Vermont's natural heritage, what threatens it, and why to consider it in a conservation or stewardship plan.

Conservation Goals: Examples of conservation goals that a town or planning group might adopt for that element.

Obtaining and Interpreting Information: A list of places – agencies, organizations, and publications – where one can get maps and information on the various elements (contact information is given in the Appendix), an example of a map showing locations of the element, and some information on how to interpret the data. In some cases, information is provided on how to gather new field data on the element.

Conservation Strategies: Example of specific conservation strategies – from encouraging private landowners to support sustainable timber harvesting, to land acquisition, to zoning regulations – that can help achieve each of the sample conservation goals presented.

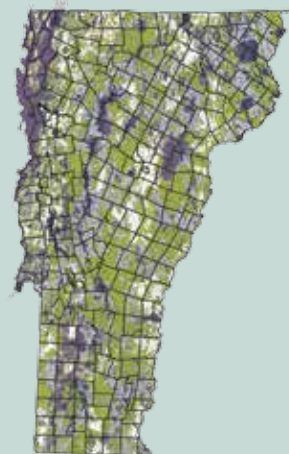
Note: The list of strategies given for each element is not exhaustive. It is important to consider strategies identified for all elements as well as the information presented in Chapter 7 to be sure that all applicable and appropriate strategies are applied to the unique circumstances of each town or area of interest. The goals and strategies presented in this part of the manual represent ideas and offer choices and opportunities to Vermont communities, organizations, and individuals planning for conservation and stewardship. They are not, however, the only strategies or goals for realizing the conservation and stewardship of Vermont's natural heritage of fish, wildlife, and diverse landscapes and habitats.



BioFinder is a map and database identifying Vermont's lands and waters supporting high priority ecosystems, natural communities, habitats, and species. The most comprehensive assessment of its kind in Vermont, BioFinder was developed by the Agency of Natural Resources and partners to further our collective stewardship and conservation efforts.

At its core, BioFinder is 21 overlapping data sets representing terrestrial and aquatic biological, ecological, and natural heritage data at various scales and aspects. A co-occurrence analysis then identified the locations of greatest overlap for priority ranking at the statewide scale. You can use the BioFinder Mapping Tool to explore the distribution and richness of Vermont's biodiversity and help secure Vermont's natural heritage for future generations.

For more information on BioFinder, please visit <http://biofinder.vermont.gov/>.



CHAPTER 3



Landscape - Level Elements



The elements covered in this chapter — contiguous forests, connecting lands, and enduring features — capture a diversity of landscapes and also represent the interests of species that have large ranges, need large forested areas, or require specific landscape features.

Contiguous Forest

Definition

Contiguous forest habitat is an area of forested land with either no roads or low densities of class III or IV roads and little or no human development (buildings, parking areas, lawns, gravel pits). Contiguous forest areas may have various age classes of forest cover and, in fact, may be composed of other habitat types such as wetlands or old meadows that are part of the overall contiguous habitat complex. Ideally, these areas are connected with other similar areas so that the animals that use them can move freely to other forested areas and habitats. It is important to keep in mind that there is no minimum or maximum number of acres to define contiguous habitat in all cases throughout the state. Rather, it is important to consider the size of the contiguous forest habitat and associated species of plants and animals within the context of the level of fragmentation in the region/area. In addition, the configuration of the habitat is also an important consideration for identifying contiguous forests. For instance, an area of forest habitat that is highly irregular in shape, with

a high degree of forest edge may be less functional for some species than forest habitat of the same acreage with a regular shape.

Importance

Contiguous forest habitat supports native plants and animals, including those species like bobcats and black bears that require large areas to survive. Such habitat, together with other important habitats such as wetlands, also supports natural ecological processes such as predator/prey interactions and natural disturbance. It also serves to buffer species against the negative consequences of fragmentation as explained in Chapter 1. For instance, many of Vermont's native migratory songbirds, including the hermit thrush (Vermont's state bird), generally require larger patches of relatively unfragmented forest habitat to ensure successful reproduction. In the absence of such habitat, these birds are greatly affected by increased rates of nest predation from raccoons, skunks, squirrels, and chipmunks as well

The conservation of large forest areas provides necessary habitat for bobcats, wood thrush, and many other species.

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as nest parasitism from brown-headed cowbirds. Many of the native migratory songbird populations are now in decline due, in part, to the loss of contiguous forest habitat, especially in southern New England.

In summary, contiguous forest habitat is important because it:

- ▶ supports the biological requirements of many plants and animals;
- ▶ supports viable populations of wide-ranging animals by allowing access to important, feeding habitat, reproduction, and genetic exchange;
- ▶ serves as habitat for source populations of dispersing animals for recolonization of nearby habitats that may have lost their original populations of those species;
- ▶ supports public access to and appreciation of Vermont's forested landscape;
- ▶ provides forest management opportunities for sustainable extraction of forest products;
- ▶ provides forest management opportunities to yield a mixture of young, intermediate, and older forest habitat;
- ▶ helps maintain air and water quality; and
- ▶ provides important opportunities for education and research of forest ecosystems.

To avoid the consequences of fragmentation and to account for the habitat requirements of wide-ranging and forest interior species, large contiguous areas of forested habitat should be identified and

conserved, keeping in mind that conservation and stewardship take many forms (see strategies). The size of the habitat necessary will depend on the conservation needs and goals of an area and the species that are being addressed. However, the general rule of thumb, given the significant risks of continued fragmentation of forest habitat due to development, is "the bigger the better." All else being equal, the conservation benefits of conserving parcels of land that are greater than 500 acres, for instance, typically will outweigh the conservation benefits of multiple small parcels of conserved land that may or may not be connected. Importantly, the fostering and promotion of enterprises such as sustainable forestry products effectively addresses the conservation and stewardship of this level of wildlife.

Conservation Goals

Below are some examples of conservation and stewardship goals that a town or other planning group might adopt:

1. Conserve and provide stewardship for existing relatively large patches of contiguous forest within the town or area of interest.
2. Conserve and provide stewardship for at least two patches of contiguous forest habitat totaling a minimum of 1,000 acres within the town. (Note that the figure 1,000 acres is not fixed, but is used here to convey the idea that establishing some sort of numerical target may be useful in directing



In a forest that is fragmented by roads and other development, non-native birds like English sparrows find a home, and native adaptable species like raccoon are abundant.



conservation efforts and evaluating the extent to which a community has realized its goals at some point in the future.)

3. Ensure the maintenance and conservation of existing contiguous forest habitat and avoid subdivision and parcelization of that habitat.
4. Ensure the viability of working lands associated with a sustainable forest products economy due to their significant contribution to this and other fish, wildlife, and natural heritage elements.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **University of Vermont Spatial Analysis Laboratory:** The University of Vermont has developed a GIS data layer that identifies contiguous forest habitat. This layer depicts those areas in Vermont that are at least 100 meters (330 feet) distant from a zone of human disturbance. Human disturbance zones are defined as developed, industrial, or residential areas, agricultural openings, and roads.
- ▶ **Vermont Fish and Wildlife Department:** The Department can provide some technical assistance in identifying contiguous forest.
- ▶ **Vermont Center for Geographic Information (VCGI):** Data layers for use with ArcView GIS software can be downloaded from the VCGI website. Data layers that are useful for locating contiguous forest include roads, surface waters, land cover, and UVM's contiguous forest layer.
- ▶ **Regional Planning Commissions:** These groups can provide information on land ownership, which is helpful in identifying large parcels that may continue to provide contiguous habitat. Most towns also have paper and/or digital tax maps available at the town offices.

Interpreting the Information

Because contiguous forest is defined by a lack of roads and development, it can be identified on topographic maps, aerial photos, and orthophotos. It is easy to identify areas of forest habitat that are not currently fragmented by identifying roads, developed land, agricultural land, and vegetative cover on the topographic or ortho/aerial photograph base layers.

The following criteria are useful for evaluating and prioritizing forest habitats:

- ▶ **Size:** Larger areas may be more ecologically valuable or provide greater benefits to the civic community in terms of providing opportunities to access, use, and enjoy the benefits of the land.
- ▶ **Condition:** Forests that have diverse habitat types within them normally have a greater variety of plant and animal species.
- ▶ **Landscape Context:** Forested areas that are near other forest patches and are well-buffered from fragmenting features like roads, development, or agricultural land function better as wildlife habitat for many species, especially those requiring interior forest conditions.

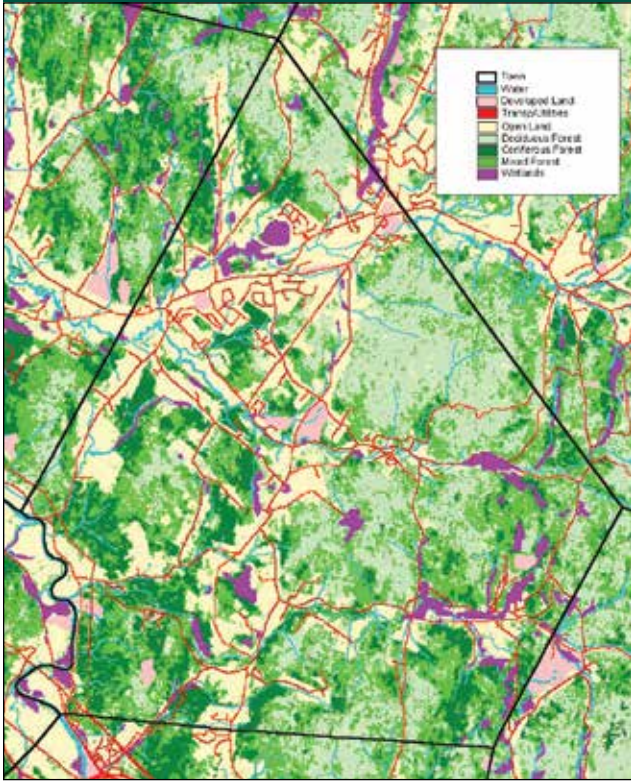
The size of contiguous forest habitat necessary to represent Vermont's conservation interests and values will vary by region. Biophysical regions provide a useful framework for understanding the minimum size of contiguous forest habitat necessary to meet a town or region's conservation needs. For instance, areas in the Champlain Valley biophysical region, such as Chittenden County, may focus on conserving relatively small forested areas — say 50 acres or more — while areas in Washington County in the Northern Green Mountain biophysical region may focus on larger areas, with a minimum of 200 acres or more.

Once an inventory of contiguous forest habitat is complete, it is useful to compare those areas to the location of conserved lands, significant habitats, habitat for rare, threatened and endangered species, wetlands, natural communities, and other relevant information.



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Land Cover in Ridgeville



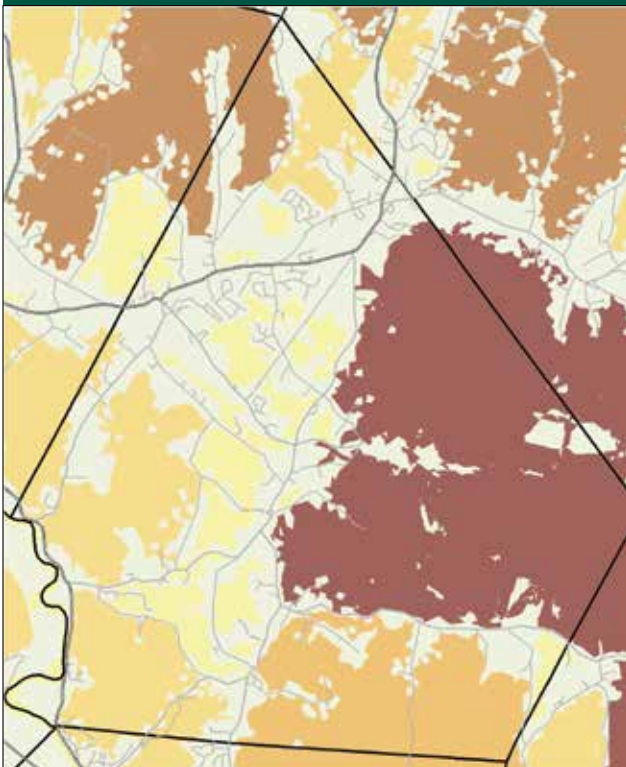
Map 3-1

This map displays land cover in the fictional town of Ridgeville, Vermont. Notice where large forested areas occur. (Source: Vermont Fish & Wildlife Department – Kevin Viani)



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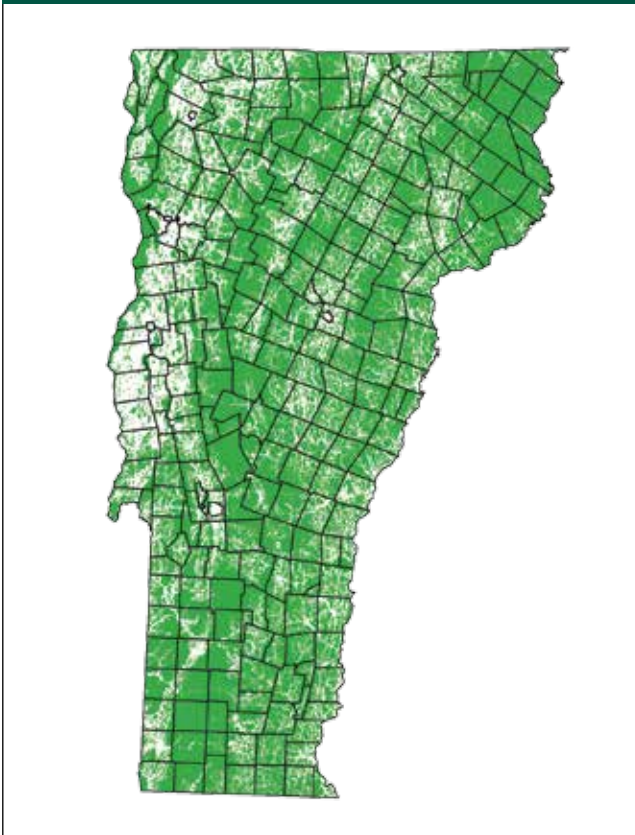
Contiguous Forest in Ridgeville



Map 3-2

This map shows habitat blocks by size in Ridgeville. These habitat blocks provide important, unfragmented habitat for wide-ranging species like bobcat and black bear, and also for birds that require forest-interior habitat to breed successfully. (Source: Vermont Fish & Wildlife Department – Jens Hilke)

Statewide Contiguous Habitat

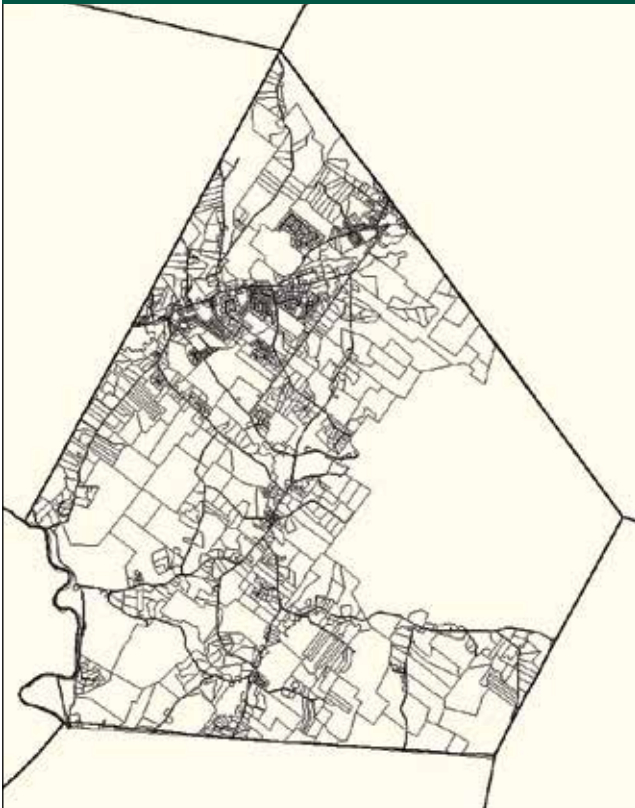


Map 3-3
Map 3-3 Statewide contiguous habitat map with town boundaries. Notice the multiple small patches of contiguous habitat in the valley regions. (Source: Vermont Fish & Wildlife Department – Jens Hilke)



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Tax Parcel Map



Map 3-4
Municipal tax maps are useful to illustrate the extent of parcelization in an area and the extent to which large, contiguous land ownerships exist. This information is useful for identifying key landowners for coordinating the acquisition of conservation easements or in negotiating land conservation with multiple landowners. An effective way to safeguard wildlife habitat is to promote a sustainable working landscape. Having landowners with large contiguous holdings fosters and promotes sustainable agriculture and forest products economies. (Source: Vermont Fish & Wildlife Department – Everett Marshall)

Gathering New Field Data on Contiguous Forest

Contiguous forest is easy to identify from maps and aerial photos, but it is often difficult to determine its condition, vegetative and habitat composition, or species composition from those sources. Therefore, field inventory and assessment should precede any conservation action. Areas identified from maps should be reviewed in the field and notes should be taken on forest condition and age, natural communities present, amount and kind of wildlife habitat, and signs of actual wildlife use.



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Conservation Strategies

Once information has been gathered on the contiguous forest areas in your town or area of interest, and preferably in surrounding areas as well, you can develop specific conservation strategies to help achieve your goals. Examples of strategies for each goal are presented below.

1. Goal: Conserve and provide stewardship of existing relatively large patches of contiguous forest habitat within the town or area of interest.

Strategies:

a. Identify patches of contiguous forest, those that are relatively large, in good condition (e.g., relatively unfragmented or undeveloped), and preferably with connections to other patches of contiguous forest. There are different ways to conserve land. For example, seek conservation easements on those areas that would either allow for sustainable forestry or limit or prevent development. (See Chapter 7 for details on local land acquisition funds and conservation easements.) In addition, one could seek to establish cooperative relationships with the landowners to educate them about the conservation value of their lands and promote sustainable forest management. For example, enrolling in Vermont's

current use program (technically called the Agricultural and Managed Forests Land Use Value Program) helps forest owners reduce the tax burden of owning forest lands while encouraging them to sustainably manage their forests. Other programs, such as Vermont Family Forests and Smart Wood Certification, can also help foster sustainable forestry while conserving fish and wildlife resources.

b. Include a map of contiguous forest patches in the town plan and include language stressing the importance of contiguous forest in conserving the town's natural heritage. **Sample Language:** *Contiguous forest habitat provides a significant contribution to the local community's interests in its natural heritage, identity, and working landscape. These lands represent much of what makes life in this area unique and enjoyable. These lands provide a myriad of ecological functions for fish, wildlife, plants, and all the natural processes that sustain them. Further, they provide extremely valuable connections for people to enjoy and appreciate the land and its abundant resources. For these reasons, contiguous forests will be supported by sustainable working lands, for the myriad contributions to our natural and cultural heritage, and for maintaining options and choices for future generations of the community. To this end, we will work to inform landowners of these values and offer assistance for any conservation actions that are in keeping with the local community's conservation interests.*

c. Establish a land acquisition fund and accompanying land conservation plan that identifies important lands in the community for potential permanent conservation. This creates the ability to target land acquisitions to make effective and efficient use of an acquisition fund. Priority areas may be large land holdings that support a sustainable forest products economy, that support rare species and related habitat(s), or support multiple natural heritage elements. This is an important component for conserving a community's interests in their natural heritage because it provides them with a guarantee that they will have access to sufficient areas of land for hunting, fishing, trapping, hiking, photography, and other compatible activities.

d. Develop a system for the transfer of development rights (TDR) that allows a greater density of development in sensible areas such as village centers and defined growth centers, conserves the rural lands of a community, and allows for an equitable sharing of investments in both the community's interests in development and in conservation. This is explained further in Chapter 7.

e. Establish a conservation district where only low-impact, low-density development and land uses can occur. All uses must be found to be compatible with the objectives of the conservation district. Establish criteria such as permitting uses that do not fragment the area or that do not require extensive clearing of vegetation. Diversify conservation districts within a town or area of interest to ensure that lands and resources at multiple elevations are included, rather than just high-elevation lands. Many of the lower-elevation areas in Vermont support the greatest biological diversity and opportunities for public enjoyment. And, as discussed in earlier sections of this manual, these areas are currently grossly under-represented by conserved lands.

2. Goal: Conserve and provide stewardship for at least two patches of contiguous forest habitat totaling a minimum of 1,000 acres within the town or area of interest. This figure is not set in stone, but will vary depending on location in the state and landscape conditions within the area of interest. Configuration of the habitat patches is also an important consideration as mentioned above.

Strategies:

a. After identifying all the patches of contiguous forest in town (or area of interest), choose two parcels that meet a predetermined target size (500 acres, for example),² or choose some reasonable combination of several large patches that achieves this goal. These parcels should be in good condition (see "condition" as defined on page 41) and have the best landscape context. Seek conservation easements in these areas. Focus education and cooperative landowner relations on these parcels to encourage private ownership that supports good forest stewardship of these parcels. The Vermont Department of Forests, Parks and Recreation offers assistance to private landowners interested in conducting sustainable forest management.

b. Same as "1c" above; acquire land and offer education and assistance to private landowners.

c. Establish an impact fee program that requires developers to pay a fee toward the protection or restoration of town-owned open space lands, forests, parks, or recreation areas. (See Chapter 7 for details.)

3. Goal: Ensure the conservation and stewardship of existing contiguous forest habitat and avoid subdivision and parcelization of that habitat.

Strategies:

a. Establish language in the town plan that supports and promotes a sustainable local and regional forest products economy. **Sample Language:** *The community recognizes the value of working lands to the regional forest products economy and to the local and regional community's ability to conserve and provide stewardship for its natural heritage of fish, wildlife, plants, ecological systems, and the myriad public values therein. Therefore, the town will explore all reasonable and feasible opportunities to support and promote those lands that are greater than 25 acres and meet any of the following criteria — (i) enrolled in the Vermont current use program; (ii) owned by persons willing to consider the sale and application of a conservation easement; (iii) are being managed in accordance with a forest management plan that has been reviewed and approved by a professional forester, wildlife biologist, or other appropriate and related professional; or (iv) owned by persons willing to consider other non-regulatory mechanisms that promote sustainable forest management or seek to otherwise conserve the lands.*

b. Create zoning ordinances that promote cluster development and prevent subdivision in the interior of large forested areas. This may be accomplished in several ways as explained in more detail in Chapter 7. For instance, a town could establish a conservation district where zoning would prohibit certain forms of development that would compromise the natural heritage values of the town. A conservation district should be designed not only for areas of high elevation where aesthetics are a concern and where steep slopes and poor soil restrict development, but it should also include those areas where large areas of land remain undeveloped and where a diversity of habitats and natural heritage elements occur together.

Another approach is to establish zoning bylaws that create incentives for development in existing town and village centers. Finally, though not widely used yet in Vermont, an effective method of conserving contiguous forest is to establish a process/system for transferable development rights (TRDs). (See Chapter 7.)

c. Incorporate language in the town plan to encourage landowners who are eligible to enroll in the State of Vermont’s current use program (information on this program can be obtained by the Vermont Department of Forests, Parks and Recreation or the Vermont Department of Taxes). This program provides tax incentives for qualifying landowners who enroll in the program and agree not to develop their forest lands and to manage them in accordance with a forest management plan developed in cooperation with the Department of Forests, Parks and Recreation.

d. To encourage cluster development and prevent the subdivision of large forested areas, allow for planned unit developments (PUDs). Require that PUD designs be used when developing in contiguous forest patches, and require or provide incentives (e.g., density bonuses) for developments to cluster structures next to existing infrastructure (e.g., roads or power lines). Require land designated as “common land” in the PRD/PUD to have a conservation easement that ensures the proper management and uses of the land that are compatible with the conservation goals and interests of the habitat. An easement can include conditions that protect and manage for certain natural heritage elements, such as wetlands or mast stands. (See Chapter 7 for details.) The easements could also ensure long-term public use of those lands.

e. Same as “1c” above. The conservation district or select forest patches can be designated as sending areas³ in a TDR program (see “1d” above and see Chapter 7 for details).

f. Develop a landowner stewardship program to encourage conservation and sustainable management of contiguous forest lands. Educate landowners about COVERTS⁴ (Woodlands for Wildlife), the state’s current use program, and other wildlife habitat and forest management programs and techniques. For example, the U.S. Department of Agriculture Natural Resources Conservation Service in Colchester, Vermont, offers several assistance and incentive programs to private landowners interested in land and habitat conservation. See appendix for contact information for all of these programs.

4. Goal: *Ensure the viability of working lands associated with a sustainable forest products economy due to their significant contribution to this and other fish, wildlife, and natural heritage elements.*

Strategies:

a. Identify patches of contiguous forest, those that are relatively large, in good condition (e.g., relatively unfragmented or undeveloped), and preferably with connections to other patches of contiguous forest. There are different ways to conserve contiguous forest. For example, seek conservation easements on those areas that would either allow for sustainable forestry or limit or prevent development. In addition, one could seek to establish cooperative relationships with the landowners to educate them about the conservation value of their lands and promote sustainable forest management. For example, enrolling in Vermont’s current use program (technically called the Agricultural and Managed Forests Land Use Value Program) helps forest owners reduce the tax burden of owning forest lands while encouraging them to sustainably manage their forests. Other programs, such as Vermont Family Forests and Smart Wood Certification, can also help foster sustainable forestry while conserving fish and wildlife resources.

b. Include a map of contiguous forest patches in the town plan and include language stressing the importance of contiguous forest in conserving the town's natural heritage. **Sample Language:** *Contiguous forest habitat provides a significant contribution to the local community's interests in its natural heritage, identity, and working landscape. These lands represent much of what makes life in this area unique and enjoyable. These lands provide a myriad of ecological functions for fish, wildlife, plants, and all the natural processes that sustain them. Further, they provide extremely valuable connections for people to enjoy and appreciate the land and its abundant resources. For these reasons, contiguous forests will be supported by sustainable working lands, for the myriad contributions to our natural and cultural heritage, and for maintaining options and choices for future generations of the community. To this end, we will work to inform landowners of these values and offer assistance for any conservation actions that are in keeping with the local community's conservation interests.*

c. Establish a land acquisition fund and accompanying land conservation plan that identifies important lands in the community for potential permanent conservation. (See Chapter 7 for details on local land acquisition funds and conservation easements.) This creates the ability to target land acquisitions to make effective and efficient use of an acquisition fund. Priority areas may be large land holdings that support a sustainable forest products economy, that support rare species and related habitat(s), or support multiple natural heritage elements. This is an important component for conserving a community's interests in their natural heritage because it provides them with a guarantee that they will have access to sufficient areas of land for hunting, fishing, trapping, hiking, photography, and other compatible activities.

d. After identifying all the patches of contiguous forest in town (or area of interest), choose two parcels that meet a predetermined target size (500 acres, for example),⁵ or choose some reasonable combination of several large patches that achieves this goal. These parcels should be in good condition (see "condition" as defined on page 41) and have the best landscape context. Seek conservation easements in these areas. Focus education and cooperative landowner relations on these parcels to encourage private ownership that supports good forest stewardship of these parcels. The Vermont Department of Forests, Parks and Recreation offers assistance to private landowners interested in conducting sustainable forest management.

e. Establish language in the town plan that supports and promotes a sustainable local and regional forest products economy. **Sample Language:** *The community recognizes the value of working lands to the regional forest products economy and to the local and regional community's ability to conserve and provide stewardship for its natural heritage of fish, wildlife, plants, ecological systems, and the myriad public values therein. Therefore, the town will explore all reasonable and feasible opportunities to support and promote those lands that are greater than 25 acres and meet any of the following criteria – (i) enrolled in the Vermont current use program; (ii) owned by persons willing to consider the sale and application of a conservation easement; (iii) are being managed in accordance with a forest management plan that has been reviewed and approved by a professional forester, wildlife biologist, or other appropriate and related professional; or (iv) owned by persons willing to consider other non-regulatory mechanisms that promote sustainable forest management or seek to otherwise conserve the lands.*

f. Incorporate language in the town plan to encourage landowners who are eligible to enroll in the State of Vermont's current use program, information on this program can be obtained by the Vermont Department of Forests, Parks and Recreation or the Vermont Department of Taxes. This program provides tax incentives for qualifying landowners who enroll in the program and agree not to develop their forest lands and to manage them in accordance with a forest management plan developed in cooperation with the Department of Forests, Parks and Recreation.

g. Develop a landowner stewardship program to encourage conservation and sustainable management of contiguous forest lands. Educate landowners about COVERTS (Woodlands for Wildlife), the state's current use program, and other wildlife habitat and forest management programs and techniques. For example, the U.S. Department of Agriculture Natural Resources Conservation Service in Colchester, Vermont, offers several assistance and incentive programs to private landowners interested in land and habitat conservation. See Appendix for contact information for these programs.

Connecting Habitat (Corridors)



Connecting habitat is land that links larger patches of habitat within a landscape, allowing the movement, migration, and dispersal of animals and plants. Riparian habitat along streams and rivers, strips of forest cover between developed areas, and even hedgerows/fencerows all represent potential connecting habitat. Sometimes these areas are called “corridors” even though they are not always linear, as the term implies.

Importance

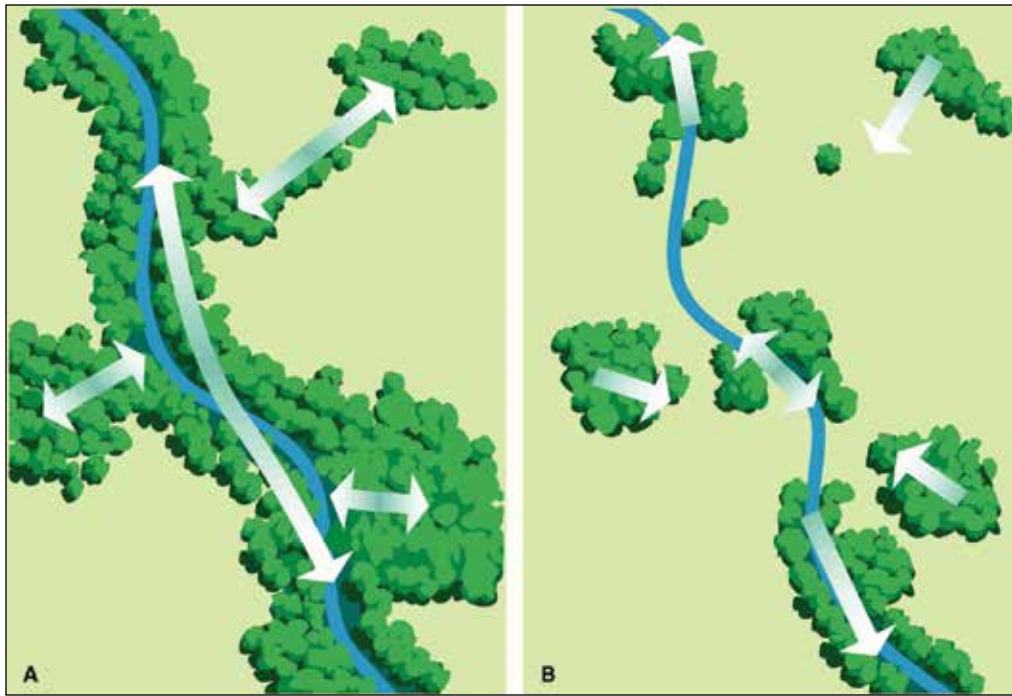
Movement of animals from one habitat patch to another is the most common function associated with connecting habitat. This function is particularly important for wide-ranging animals, such as bobcats and black bears, or for animals that require a great deal of space to meet their daily life needs, such as barred owls or otter. Although connecting habitat is often associated with wide-ranging mammals, it is equally important for animals with relatively small ranges. Spotted salamanders, for example, use connecting habitat in spring to move from their hibernation sites to breeding pools.

The value of connecting habitat is a function of both seasonal and spatial patterns of wildlife behavior. For example, connecting habitat may allow black bears to access important food resources during a specific time of year (seasonal), or it may prevent isolation

of bear populations by allowing free exchange of breeding adults (spatial). Ultimately, connecting habitat can ensure that the habitat, movement, migration, and behavior requirements of most native plants and animals are conserved across a broad landscape.

The broader ecological value of connecting habitat is to join fragmented pieces of habitat, thereby reducing the deleterious effects of habitat fragmentation and population isolation. Linking small or otherwise isolated habitat patches may reduce the risk of local population extinctions by ensuring immigration, recolonization, reproduction, and exchange of genes for some plant and animal species.

Connecting habitat is also important in the context of climate change. The network of connected lands across Vermont that includes both core and connecting habitats is essential to allow plants and animals to move and migrate as the climate changes. Studies suggest that populations of species are already adjusting their home ranges to adapt to new conditions (need to include a citation or reference). These changes are not only represented by migrations northward in response to warming temperatures, but a more complex pattern that also involves changes in soil moisture and micro-climates. Movement in response to climate change may not be in only one direction. Therefore the overall network of connected land in Vermont and throughout the northeast region



Map 3-5
 Landscapes with (A) high and (B) low degrees of connectivity. Corridors are particularly important for wide-ranging species whose habitat needs are not accommodated by a single patch of suitable habitat. (Source: Federal Interagency Stream Restoration Working Group (FISRWG)).

is instrumental in allowing for migration of both plants and animals as our climate changes.

The importance of maintaining habitat connections should be considered at two different scales. First, as presented in this chapter it should be considered at the landscape scale. At this scale, connectivity is important for connecting populations of wildlife over large areas or within a region to allow for genetic variability and ensure migration. For instance, maintaining connections between the Green Mountains of Vermont and the White Mountains of New Hampshire allows for populations of wildlife in those areas to remain diverse and abundant and hence more likely to withstand the effects of disease or other significant impacts. Second, habitat connectivity must be considered at a more local scale where roads overlap with the network of connected habitat.

In some cases, fish and wildlife movement associated with specific road crossing areas is seasonal, as evidenced by salamander spawning migrations in early spring, and in other cases it could be simple happenstance of an animal curious for new food sources on the other side of the road. Both the landscape and local scales are important and should be thought of somewhat separately for town planning, adopting more general standards at the landscape scale, and much more specific and rigorous ones at the local road crossing scale.

While conserving connecting land has great merit, do not assume that conserving narrow threads of vegetative cover within a developing landscape will maintain an area's ecological values and biological diversity. Nor will corridors alone meet the habitat needs of all of an area's plant and animal species. Only in conjunction with the conservation of large areas of



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Roads and associated traffic are often a primary source of habitat fragmentation and can affect movement patterns of wildlife and potential for connecting habitat. Areas where animals repeatedly cross roads are often associated with certain topographic features and vegetation characteristics. In Vermont, black bears tend to cross class III and IV roads in areas with dense forest and shrub cover, often along streams, with topographic relief that serves as cover. They tend not to cross class I and II roads. This is likely due to the wide, paved character of class I and II roads as well as the high volume of daily vehicular traffic and associated development (Hammond, 2002).

undeveloped land with diverse habitat conditions, and the maintenance of a sustainable working landscape, will vegetative corridors assist in supporting ecosystem functions and related public benefits.

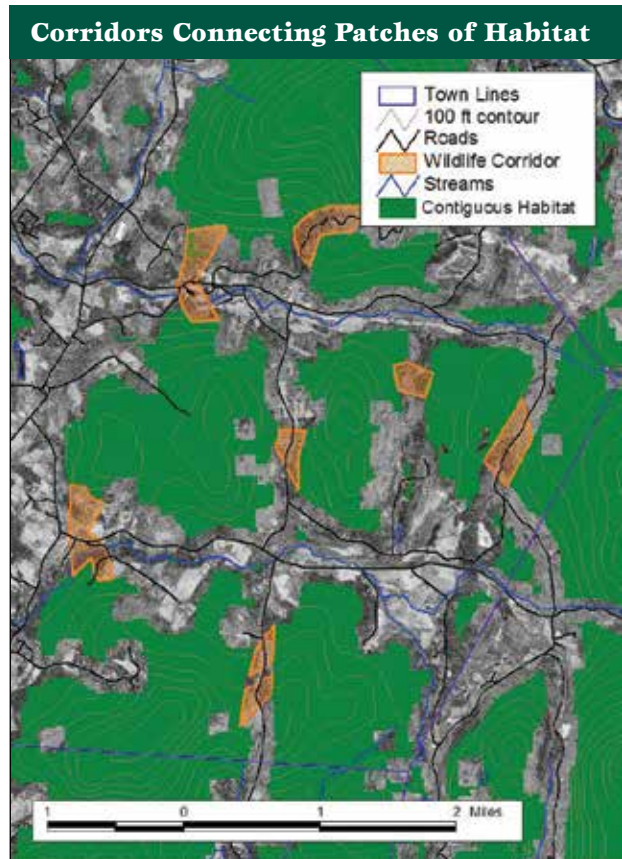
In summary, connecting (corridor) habitat is important because it does the following:

- ▶ Allows animals to move freely across their range;
- ▶ Allows plants and animals to colonize new habitat as climate change, succession, or other ecological processes force them to migrate;
- ▶ Reduces the risk of population isolation and provides for the exchange of genetic information among populations of animals and plants;
- ▶ Allows animals to access suitable habitat to meet their daily and annual life needs;
- ▶ Allows seasonal movements (migrations) to essential range or habitat;
- ▶ Allows young adult animals to access new range, away from natal range; and
- ▶ Allows adult animals to interact with potential mates, thus improving reproductive success and genetic fitness.

Conservation Goals

A town or other planning group might adopt goals like the ones below for the conservation of connecting habitat:

1. Ensure that animals and plants are able to move freely between conserved lands, undeveloped private lands, contiguous forest habitat, and other important habitats, land features, and natural communities in order to meet all their necessary survival requirements. This may be accomplished by an increase in the number of acres of connecting lands/corridors under land stewardship and/or that are permanently protected or conserved.
2. Ensure that animals and plants can move long distances — beyond the boundaries of the town or area of interest — as they need to for breeding, dispersal, and adaptation to climate or habitat change, for example.



Map 3-6 This map shows areas where animals might be predicted to move from one patch of habitat to another. The predictions are based on available forested habitat adjacent to both sides of the road, presence of drainage areas or streams, changes in topography, and areas of developed land. (Source: Vermont Fish & Wildlife Department – Jens Hilke)



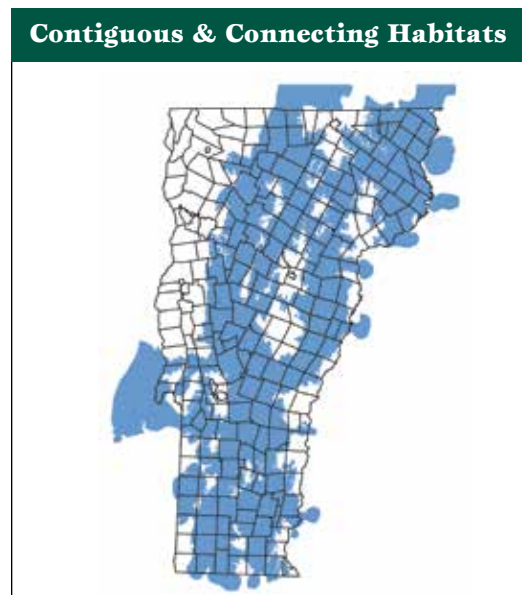
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Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **Vermont Fish and Wildlife Department:** The Department maintains information on road-related wildlife mortality throughout Vermont. This information indicates where wildlife commonly cross roads.
- ▶ **Hunters and Trappers:** These residents often have excellent information about where animals move, how they get from one habitat patch to another, and where they try to cross roads.
- ▶ **United States Geological Survey:** Topographic maps from the USGS are a basic tool for identifying potential connecting habitat. These are available in paper format from USGS, the Vermont Geological Survey, and bookstores.
- ▶ **Regional Planning Commission:** These groups can provide orthophotos for use in locating potential connecting habitat.



Map 3-7 This map shows a mix of contiguous habitats and connecting habitat that are all part of the network of connected land in Vermont and throughout the northeast region. This network shows regionally-significant areas for the movement of far ranging animal species. Locally significant movement of a variety of animal species also occurs outside of this regionally significant network. (Source: Vermont Fish & Wildlife Department – Jens Hilke)”

Interpreting the Information

Like contiguous forest, the location of connecting habitat is determined by the configuration of developed lands and topography. It is also determined by the distribution of bodies of water and associated riparian areas, of existing conserved lands that could be connected in a sensible way, and the distribution of private tracts, especially those that are larger or those that provide critical corridors in which the landowner is interested in long-term stewardship .

The following criteria are useful in evaluating and understanding information on connecting habitat:

1. Determine whether existing conserved lands or other areas of important habitat have potential connections (for example, ridgelines, drainage basins, riparian habitat).
2. Rivers and streams should have wide naturally vegetated riparian habitat (for example, greater than 100 feet wide on at least one side of a river or stream that appears to connect habitats upstream and downstream of the corridor).
3. Identify areas of habitat between areas of development along roads where animals are known to cross repeatedly. These areas are termed bottlenecks and are often very important connecting habitat, allowing animals to move within a developing landscape and access important habitat on both sides of a road. Consider a broad array of habitats that may compose a corridor. It is a misconception that corridors are long, narrow strips of mature forest. In fact, a corridor may be wide, irregular in shape, and composed of young forest, shrub, and early successional habitats.
4. Determine which landowners are interested in the long-term stewardship of connecting habitat.

Conservation Strategies

Once information has been gathered on connecting lands, you can develop conservation strategies to help achieve your goals. Examples of strategies for each goal are presented below.

- 1. Goal: Ensure that animals and plants are able to move freely between conserved lands and lands under long-term stewardship, contiguous forest habitat, and other important habitats, land features and natural communities to meet all their requirements for survival by increasing the acreage of connecting lands.**

Strategies:

- a.** Adopt language in a town plan or other related document(s) that support the protection of important wildlife corridors and connecting lands. **Sample Language:** *Important wildlife corridors will be protected or conserved from encroaching development and incompatible activities, such as road expansion or development of new roads, by restricting development in and around corridors. These resources will be given high priority in considering lands for acquisition or other long-term conservation efforts.*
- b.** Use conservation easements, fee acquisition, and/or zoning (such as overlay districts) to establish a network of connecting habitat within a town that connects all conserved lands, lands under long-term stewardship, or other habitats identified as important for this goal.
- c.** Develop a system for the transfer of development rights (TDR) that targets the conservation of lands supporting important wildlife corridor functions or that are otherwise significant for connecting conserved lands and lands under long-term stewardship, habitats, or the landscape in general. (See Chapter 7 for details.) Implementation of a TDR program should consider other elements for conservation of public interests and general welfare; it should be used to support the conservation of the public's interests in all the natural heritage elements presented herein.
- d.** Gather information pertaining to locations along town and state roads where wildlife is known to frequently cross. These areas may serve as important wildlife corridors and can serve as the basis for a broader corridor inventory. Incorporate a map of this information into the town plan, or other open space plan, and prioritize these areas for conservation.
- e.** Adopt town road management standards designed to conserve wildlife corridor functions by avoiding the installation of guardrails (where possible), avoiding the removal of roadside vegetation, or avoiding roadside ditching in existing corridor areas.
- f.** Allow for PUDs in town zoning and/or subdivision regulations as an alternative to conventional subdivisions, and require or provide incentives (e.g., density bonuses) for PUD designs that cluster development away from important corridors.

Retain natural landscapes along roads where animals, such as black bear, moose, and bobcat, are known to cross repeatedly over time. The Vermont Fish and Wildlife Department has a database with this information that should be consulted when considering connecting lands in the context of

local and regional planning. Consider providing underpasses or other aids to wildlife movement across major roads where road-related wildlife mortality is frequent.

- g.** Establish a land acquisition fund and an accompanying plan that identifies, among other things, connecting lands/corridors as important natural heritage elements that should be considered for funding. (See Chapter 7 for details.) Work with neighboring towns, wildlife biologists from the Vermont Fish and Wildlife Department and other experts, such as the Keeping Track, Inc. organization, to identify important regional travel corridors and connecting lands. Seek to protect these through long-term stewardship, conservation easements, and fee acquisition of important lands. Try to maintain the specific features of the corridor that make it effective.
- h.** Incorporate development setbacks from mapped corridors into town zoning regulations. This can be accomplished by creating a zoning district or an overlay district that includes mapped corridors.

2. Goal: *Ensure that wildlife can move long distances — beyond the boundaries of the town or area of interest — as they need to for breeding, dispersal, and adaptation to climate or habitat change.*

Strategies:

- a.** Learn about statewide and regional conservation plans that address large-scale wildlife movement and seek to assist in addressing the goals of those plans as they apply locally. The Vermont Fish and Wildlife Department offers information pertaining to these plans and related efforts. Many of the strategies identified for goal 1 will also serve to achieve this goal.
- b.** Consider the conservation of connecting lands and wildlife corridors beyond town boundaries. Invite the participation of other towns within a watershed or biophysical region, for example, to consider conserving those lands that cross town boundaries and that are important for the movement of wide-ranging wildlife and connecting important habitats. These efforts could be memorialized and implemented through watershed plans or agreements between town planning and conservation commissions to provide stewardship for or conserve lands that represent important corridors in similar fashion. Consider working with local and regional land trusts and similar local conservation organizations experienced in managing land acquisition and conservation easements.

Enduring Features

Definition

Enduring features are the parts of the landscape that resist change. They are the hills and valleys, the underlying bedrock, and the deposits left behind by glaciers. They remain the same even when changes in land cover and wildlife occur. They remain the same as plants and animals move, and they remain the same even as the climate changes.

If we liken nature to a dramatic play, we can think of the enduring features as the stage and the individual species as the actors. The play is the natural community that occurs in a given place at a given time, with all its interactions, but regardless of the action, the stage does not change.

Four kinds of enduring features are considered here:

- ▶ bedrock – the rock that underlies upper surface material;
- ▶ surficial materials – the gravel, sand, silt, clay, and peat that sits on top of the bedrock;
- ▶ elevation – strongly influences climate; and
- ▶ topography or landforms – mountaintops, sideslopes, and valleys.

Importance

Enduring features are important in conservation planning because they can serve as a *surrogate*, or substitute, for information on natural communities and species when that information is not available. Conservation of or providing long-term stewardship for the diversity of enduring features will in turn help protect the diversity of natural communities and species.

Some enduring features are helpful in locating specific natural communities and species. For example, we know that in Vermont the community called Valley Clayplain Forest is found exclusively on clay soils. And, two of its component plant species, bur oak and barren strawberry, are also most common on those soils. Therefore, it is possible to examine information on surficial geology to determine where clay deposits exist and, with that information, predict the potential location of a Valley Clayplain Forest and its component species. Ecologists and conservation planners have used this technique successfully to locate places where they should look for significant natural communities or rare species.

The Vermont Biodiversity Project (VBP) analyzed enduring features throughout the state and found some interesting patterns. First, the greatest diversity of enduring features is in the lowlands, where calcareous rocks tend to be found and where glacial meltwaters deposited a variety of sand, gravel, and clay formations. Second, the greatest amount of conserved land is found at high elevations, away from the diversity of the lowlands. To ensure long-term conservation of Vermont's biodiversity, more conservation, especially of large landscapes, will need to occur in lowland areas. This same analysis identified a number of specific areas throughout the state that contain enduring features that are not protected on any conserved lands. These are called "complementary landscapes" because their conservation would complement the enduring features that are already protected. See Figure 3-1.

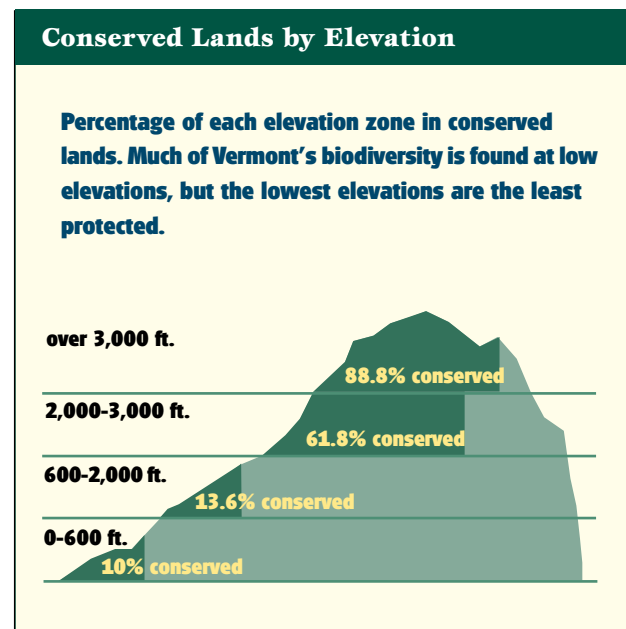


Figure 3-1 Conserved Lands versus Elevation
(Source: Vermont Biodiversity Project)

Conservation Goals

A town might set one or more of the following conservation goals for enduring features:

1. Ensure that conserved lands or lands under long-term stewardship cover the full range of elevations in the town.
2. Ensure that conserved lands or lands under long-term stewardship in the town cover all the town's bedrock types and surficial geology types, especially those types that are unusual in the state.
3. Ensure that conserved lands or lands under long-term stewardship encompass a diversity of landforms.
4. Seek to conserve or provide long-term stewardship of the complementary landscapes identified by the Vermont Biodiversity Project (see *Vermont's Natural Heritage*). Sometimes this will require cooperation with neighboring towns.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **The Vermont Biodiversity Project (VBP):** The VBP did a detailed analysis of enduring features including bedrock, surficial geology, landforms, and elevation. Interpreting these analyses requires the assistance of a natural resource professional. The VBP website explains the project and these analyses, and their report, *Vermont's Natural Heritage*, provides more detailed information and results.
- ▶ **The Vermont Center for Geographic Information (VCGI):** This group maintains digital data provided by the Vermont Biodiversity Project, as well as data on geology and soils.
- ▶ **Vermont Geologic Survey (VGS):** The survey is part of the Vermont Agency of Natural Resources and can provide data on surficial and bedrock geology for your area.
- ▶ **The Natural Resources Conservation Service (NRCS):** The NRCS can provide information on soils and can help you interpret that information.

Interpreting the Information

The five maps show four different components of the enduring features of the fictional town of Ridgeville. The bedrock map shows that two classes of bedrock (as defined by the Vermont Geologic Survey for the Vermont Biodiversity Project) occupy most of the town. Each area of bedrock may support slightly different vegetation types.

The map of soils shows many different types in the town. Interpreting the soils map requires the help of a professional, but one thing that is clear is that there are more kinds of soils in the low areas, where roads and development are more prevalent.

The map of landforms is useful for locating unusual landforms in the town, including cliffs and steep slopes, as well as specialized landforms, such as caves, which may harbor uncommon communities or rare species.



Map 3-7 The soils in Ridgeville are diverse, and different types are found in the valleys and uplands. A soil map like this can help you locate unique community types. (Source: Vermont Fish & Wildlife Department – Everett Marshall)

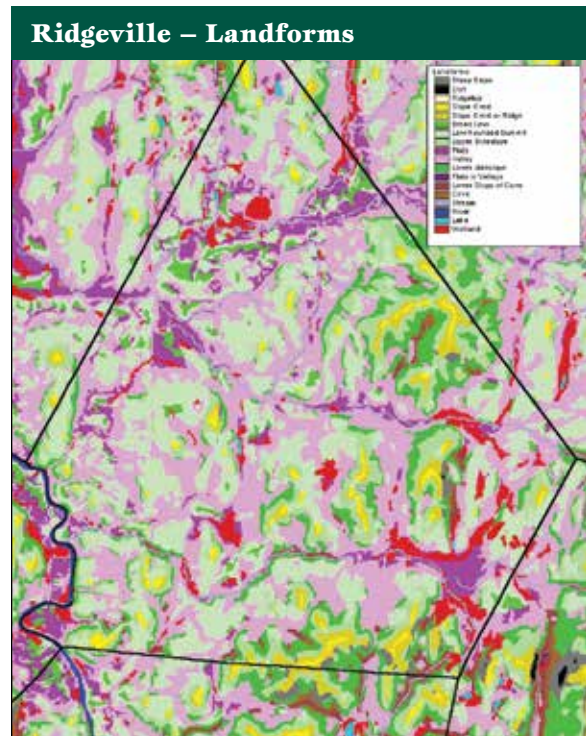
Conservation Strategies

Once information has been obtained on enduring features and conservation goals have been established, it is possible to develop conservation strategies to help achieve those goals. Examples of strategies specific to each goal follow.

1. Goal: *Ensure that conserved lands or lands under long-term stewardship cover the full range of elevations in the town.*

Strategies:

a. Include a map of elevation zones in your town plan and emphasize the importance of conserving land within each elevation zone. **Sample Language:** *In order to ensure the conservation of a diversity of landscapes and their associated plant and animal communities in town, lands will be under long-term stewardship or permanently conserved in each of the following elevation zones: 0-800 feet; 800-1,700 feet; 1,700-2,500 feet, 2,500-3,900 feet; and above 3,900 feet.*



Map 3-8 A diversity of landforms can be found in Ridgeville, from the ridges that give the town its name to the stream valleys that wind their way through town. See also figures on pages 12-13. (Source: Vermont Fish & Wildlife Department – Kevin Viani)

This same language can be adapted to include the goals of conserving bedrock types, surficial soil types, and complementary landscapes.

b. Compare elevation maps to conserved lands or lands under long-term stewardship in town to see in which elevation zones conserved lands are located. If there are elevation zones that do not have any conserved lands or lands under long-term stewardship, make conservation in those zones a priority by developing plans and programs for open space and land acquisition.

c. In addition to direct land acquisition, conservation of lands representing specific elevation zones can also be accomplished through the establishment of conservation easements on common land designated in PUDs and through TDR programs. (See Chapter 7 for more information on PUDs and TDRs.)

2. Goal: *Ensure that conserved land, or land under long-term stewardship, in the town cover all the town's bedrock types and soil types, especially those types that are unusual in the state.*

Strategies:

a. Include a map of bedrock types and soil types in your town plan and emphasize the importance of conserving land representing as many of these bedrock and soil types as possible. Note which types are currently underrepresented in conserved lands and lands under long-term stewardship in town. Example language can be adapted from “1a” above.

b. Compare VBP data layer of bedrock types to conserved lands or lands under long-term stewardship in town to see which bedrock types are not represented. Make conservation or stewardship of these bedrock types a priority in your open space and land acquisition plans and programs. Do the same with soils and surficial geology.



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3. Goal: *Ensure that conserved lands or lands under long-term stewardship encompass a diversity of landforms.*

Strategies:

a. Include a topographic map of the town in your town plan and emphasize the importance of conserving land representing as many of the landforms (e.g., valleys, steep slopes, gentle slopes, flat valley floors) as possible. Note which landforms are currently under-represented in conserved lands or lands under long-term stewardship in town. Language can be adapted from 1a on page 55.

b. Compare VBP data layer of landforms to a map of conserved lands or lands under long-term stewardship in town to see which landforms are not represented in conserved lands. Seek the advice of an ecologist to determine whether those landforms are important to meeting other conservation goals. Make conservation or stewardship of these landforms a priority in your open space and land acquisition plans and programs.



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4. Goal: *Seek to conserve the complementary landscapes identified by the Vermont Biodiversity Project (see Vermont's Natural Heritage). Sometimes this will require cooperation with neighboring towns.*

Strategies:

a. Include a map of the complementary landscapes that occur in your town in the town plan and emphasize the importance of conserving these landscapes. Examine the complementary landscapes data layer and compare it with conserved lands or ones under long-term stewardship in your town and neighboring towns. Note in your town plan which complementary landscapes are currently not conserved or under long-term stewardship. Language can be adapted from “1a” on page 55.

b. Make the conservation of complementary landscapes that are not already conserved a high priority in open space, stewardship, and land acquisition plans and programs.

c. Because complementary landscapes are discrete polygons, many conservation strategies can be applied to them that are not as suitable for the other types of enduring features. These strategies include:

i. Complementary landscapes in an overlay district with specific conditions designed to protect these features from development in and near the features; and

ii. Allowing for PUDs in the town zoning and/or subdivision regulations as an alternative to conventional subdivisions, and require or provide incentives (e.g., density bonuses) for PUD designs that cluster development away from complementary landscapes and protect them with conservation easements.

CHAPTER 4



Community-Level Elements



This level consists of four elements: **natural communities, wetlands, riparian habitats, and vernal pools.** The classification of natural communities helps biologists to locate and understand their distribution, which ultimately helps protect and conserve many native species and ecosystem processes. Although wetlands and vernal pools are classified as natural communities, they are so critical for wildlife habitat that they merit separate discussion. Riparian habitats consist of upland, wetland, and aquatic communities that together provide many functions, including maintaining water quality, providing shade to keep trout streams cool, serving as travel corridors for animals, and providing specialized habitat for plants and animals.

Natural Communities

Definition

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, it is possible to describe these repeating assemblages as natural community types.

Importance

Identifying natural communities is a powerful tool for developing effective land management plans, determining conservation priorities, and increasing our understanding of the natural world.

The Vermont Fish and Wildlife Department (VFWD) currently recognizes 80 upland and wetland natural community types in Vermont (Thompson and Sorenson, 2000). Some examples of upland natural communities are Northern Hardwood Forest, Montane Spruce-Fir Forest, and Temperate Calcareous



Figure 4-1 Northern Hardwood Forest, an S5 Community Type. (Source: Libby Davidson, Illustrator/Vermont Fish and Wildlife Department)”

Cliff, while examples of wetland natural communities are Red Maple-Black Ash Swamp, Cattail Marsh, and Black Spruce Woodland Bog. Each community type is assigned a state rank that describes the rarity of that community type in Vermont. State ranks range from S1 (extremely rare) to S5 (common and widespread) and are based on the number of known examples, the total area occupied, and the degree of threat.

Each example of a natural community that is evaluated by the Department’s Fish & Wildlife’s (DFW) Nongame and Natural Heritage Program (NNHP) is also assigned a quality rank. This measure is intended to compare occurrences of a particular community type with others statewide or with types in a particular biophysical region in the state. The quality ranks range from excellent (A) to poor (D) and are based on specifications developed for each of the 80 natural community types. These rankings are based on an assessment of the natural community’s size and current condition and the landscape context. In general, the higher the rank, the more likely it is that the community will be viable over long time periods. The overall significance of a natural community occurrence is tied both to its state rank — how rare it is in Vermont — and to its quality rank, a measure of the size and condition of that particular occurrence.

In Vermont, inventories for significant natural communities have taken place at the county and watershed level. Only a few towns have also completed such inventories. Statewide inventories have also been conducted for specific natural community types, such as Northern White Cedar Swamps.

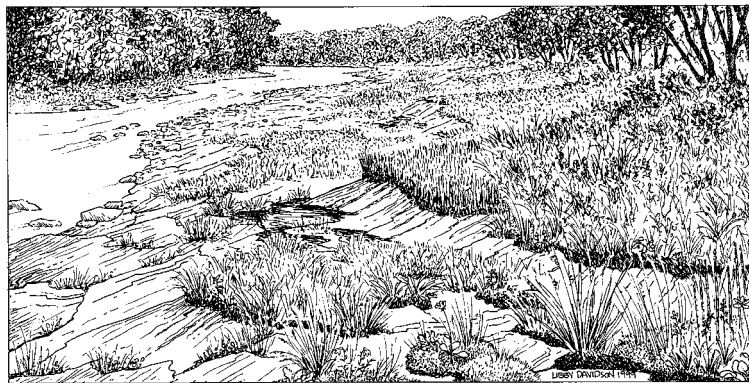


Figure 4-2 Calcareous Riverside Seep, an S1 community type. (Source: Libby Davidson, Illustrator/Vermont Fish and Wildlife Department)”

Identification of significant natural communities can help to focus town efforts on those areas that need conservation and management attention. The VFWD and the Vermont Department of Forests, Parks and Recreation have a program to map natural communities on all state lands as part of the land management planning process. In using this method, all natural community types and occurrences are mapped and categorized, regardless of rarity and significance. The natural community base mapping method is being used to develop long-range management plans of state lands. Completing a base map of all natural communities in a managed area can further focus stewardship and protection needs. It also can assist with identification of important wildlife habitat and corridors.

Conservation Goals

A town or other planning group might adopt goals like these for the conservation of natural communities:

1. Ensure the conservation and/or proper stewardship of *significant* natural communities found within the town or area of interest.
2. Restore degraded but potentially significant natural communities to a viable condition in places where the land is suitable.
3. Ensure that within your biophysical region large-scale natural communities like Northern Hardwood Forests are conserved or are under long-term stewardship in parcels large enough (e.g., thousands of acres) to function ecologically with as great a breadth as possible. This may require multi-town efforts.

Obtaining and Interpreting Information

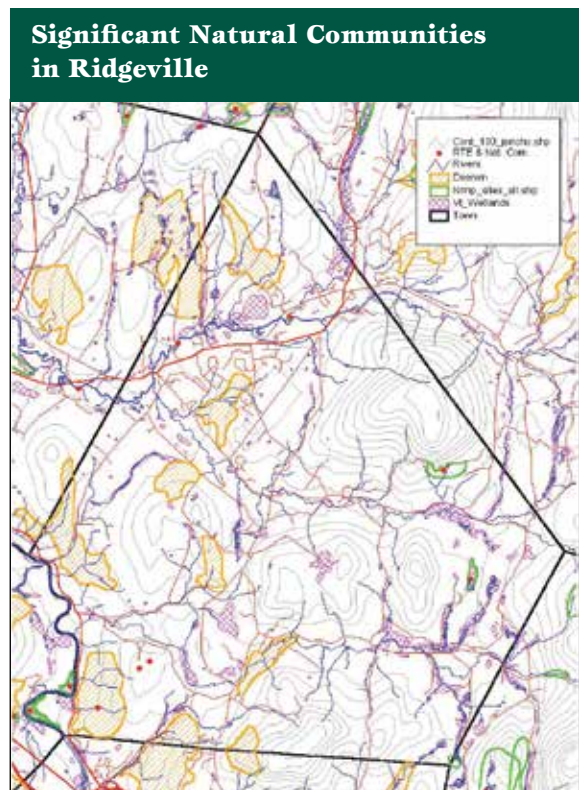
Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- **Vermont Fish & Wildlife Department’s Natural Heritage Inventory (NHI):** This program maintains the state’s information on significant natural communities. Occurrences of significant natural communities are written up as site reports that include management recommendations. The NHI oversees statewide inventories of specific natural community types, such as Riverine Floodplain Forests, and also conducts major geographic inventories, such as county or watershed inventories.

- **The Vermont Center for Geographic Information:** The Center distributes statewide geographic point data on natural community occurrences in digital format that were developed by the VFWD Natural Heritage Inventory.

- ***Wetland, Woodland, Wildland, A Guide to the Natural Communities of Vermont:*** This thorough and clearly written guide can help you identify and understand the natural communities in Vermont. This book provides clear descriptions of the 80 different natural community types recognized in Vermont, along with information on their rarity and conservation status, and explains the relationship of natural community types recognized in Vermont, along with information on their rarity and conservation status, and explains the relationship of natural communities to biophysical regions in the state. (See “Bibliography and Works Cited,” Thompson and Sorenson, 2000.)



Map 4-1 The points shown here represent significant natural communities identified by the VFWD. (Source: Vermont Fish & Wildlife Department – Everett Marshall)

Gathering New Field Data on Natural Communities



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Natural community mapping involves three steps: landscape analysis (selecting areas of interest via paper maps or GIS), landowner contact, and field survey. Natural community mapping should be done by or with direction from an expert, preferably one familiar with the natural communities of the state.

Step one, landscape analysis, includes review of wetland base maps (such as National Wetland Inventory maps), aerial photographs (including ortho and color infrared ones), geologic maps, topographic maps, and soil survey information.

Step two, contacting the landowner, is essential to increase awareness, gain support, and obtain valuable information about the land being considered. It is critical to secure the landowner's permission before conducting any field investigations.

Step three, field survey, is the process of walking the land and gathering site-specific data from which a final map and report can be made. The VFWD can provide details about the methods used.

- **Local residents:** People who live in an area can often provide valuable information about unusual natural communities.

Interpreting the Information

The map shows the significant natural communities that the VFWD identified in the fictional town of Ridgeville. A word of caution: Most towns, including Ridgeville, have NOT been thoroughly inventoried for natural communities — there are almost surely more to be found.

Significant natural communities vary in their size and sensitivity. Rich Fens, which tend to be very small (often less than two acres), can easily be disturbed by human activities. Even foot traffic can affect ecosystem functions in these areas. Larger natural communities, such as Mesic Red Oak-Northern Hardwood Forests or Rich Northern Hardwood Forests, are able to withstand various types of uses, such as sustainable forestry and recreational trails. In both development and conservation planning, evaluate not only the type and rarity of the natural community but also its inherent size and quality. This evaluation will help determine how sensitive the natural community type is to disturbance or development.

Conservation Strategies

Once information has been gathered on natural communities, it is possible to develop specific conservation strategies to help achieve the conservation goals. Examples of strategies for each goal follow.

1. Goal: *Ensure the conservation and proper stewardship of significant natural communities found within the town or area of interest.*

Strategies:

- Conduct additional field inventories to locate unmapped significant natural communities to obtain a complete inventory and understanding in the town or area of interest. Some areas in Vermont have not been thoroughly inventoried for significant natural communities, so additional information is useful. Identified examples may include those with statewide significance as well as those considered locally significant.
- Target significant natural communities in open space planning and land and easement acquisition programs.

c. Conserve significant natural communities by including them in an overlay district. (See Chapter 7.) **Sample Language:** *The purpose of the natural community overlay district is to maintain the quality rank of significant, rare, and unique natural communities identified in the town natural community inventory. Development shall be limited and, where necessary, appropriate buffers shall be established. Buffer widths will be based on the size, condition, and significance of the natural community, upon consultation with and review by the Vermont Fish and Wildlife Department.*

d. Hold a community/public forum to educate the public about significant natural communities that occur both in the town and the biophysical region. Discuss which natural communities are rare and the threats to their integrity.

e. Provide information about significant natural communities to individual landowners and land managers who own lands that support these resources. Work with them to develop conservation and/or restoration plans as appropriate.

2. Goal: *Restore degraded but potentially significant natural communities to a viable condition in places where the land is suitable.*

Strategies:

a. Use historical information to learn about significant natural communities in the town or study area that have been lost or severely degraded. Develop restoration plans for those communities in cooperation with qualified experts. Contact the Vermont Fish and Wildlife Department or other qualified experts for assistance. Develop a landowner stewardship program to encourage restoration of significant natural communities. Inform landowners about federal cost-sharing habitat restoration programs, such as the Natural Resource Conservation Service's Wildlife Habitat Incentives Program (WHIP) and the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife program. (See Appendix.)

b. Initiate an impact-fee program that requires developers to pay towards protection or restoration of town-owned open space lands, forests, parks, or recreation areas. These impact fees can be used to upgrade and manage these lands, including restoration of significant natural communities or other natural heritage elements. (See Chapter 7 for more information on impact fees.)

3. Goal: *Ensure that within your biophysical region, large-scale natural communities like Northern Hardwood Forests are conserved or are under long-term stewardship in parcels that are large enough (e.g., thousands of acres) to function ecologically with as great a breadth as possible. This may require multi-town efforts.*

Strategy:

Work with neighboring towns, state and regional conservation organizations, and land management agencies to identify and provide stewardship of, and in some cases conserve, large-scale natural communities such as Northern Hardwood Forests.



Pitcher plant is a rare plant unique to certain bog communities.

Wetlands

Definition

Wetlands are intermediate habitats between upland and aquatic ecosystems. 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, hillside seeps, and wet flats.

Although many definitions have been developed for the term and concept of “wetland,” wetlands have three basic characteristics. First, all are inundated by or saturated with water for varying periods during the growing season. Second, they contain wet or hydric soils, which develop in saturated conditions. Finally, they are dominated by plant species that are adapted to life in saturated soils. Methodologies for identifying and delineating locations of wetland boundaries for regulatory purposes have been based on developing specific definitions for each of these three wetland characteristics, known technically as hydrology, hydric soils, and hydrophytic vegetation.

Wetlands are known by many common names, and in recent years these names have been applied more consistently to specific 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, also peat-accumulating wetlands, are isolated from mineral-rich water sources by deep peat accumulation and therefore receive most of their water and nutrients from precipitation. Each of these wetland types supports a unique group of plants and animals, many of which require these wetland habitats to survive.

Importance

Wetlands serve a wide range of functions and are beneficial to a variety of native plant and animal species, as well as to the health, safety, and welfare of the general public. Wetlands provide fish and wildlife habitat, flood and erosion protection, nutrient and pollution filtration, groundwater recharge, aesthetic diversity, and sites for educational and recreational activities.



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It is estimated that less than 5% of Vermont is currently wetland and that nearly 50% of Vermont’s historic wetland area has been lost or severely impaired due to draining, dredging, filling, or excavation activities associated with industrial, residential, and agricultural activities. Since 1995, the current rate of regulated wetland loss in Vermont is estimated at 20 acres per year. In addition, there is likely a similar amount of unregulated wetlands that are lost each year. The most effective way to ensure the continuation of wetlands is to provide stewardship of and/or protection for those that still exist. In Vermont, we have relatively strong wetland protection from the following state and federal laws: U.S. Army Corps of Engineers Section 404 permits; Vermont’s Act 250; and the Vermont Wetland Rules.

Although the technology exists to create new wetlands, the process is expensive and often results in wetlands of low quality compared to natural wetlands. However, a growing interest in the restoration of abandoned agricultural lands to Valley Clayplain Forests and Riverine Floodplain Forests, may eventually lead to an increase in wetland acreage over time.

Wildlife functions associated with wetlands in Vermont are some of the most diverse and sensitive. Vermont’s wetlands support a myriad of waterfowl, wading birds, wetland-dependant furbearers, black bears, moose, amphibians, pitcher plants — the list goes on and on. These species all rely, in whole or in part, on wetland ecosystems for their survival.

Fish and wildlife that depend on wetlands for their survival tend to be easily disturbed or negatively affected by human activities. Residential development, for instance, close to a marsh that supports wading

birds such as herons and bitterns is incompatible. Domestic activities normally associated with residential development



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can cause disturbance, temporary displacement, or complete abandonment of the wetland by a variety of sensitive wetland-dependent wildlife.

Conservation Goals

A town or other planning group might adopt goals for the conservation of wetlands like the following:

1. Protect or provide for long-term stewardship of wetlands that support significant functions and values for natural communities, rare species habitat, or wildlife habitat, and prevent additional loss of wetlands within the town.
2. Restore and/or enhance the functions and values of wetlands already affected by human disturbance.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service (USFWS):** This is the agency responsible for mapping wetlands throughout the United States. Each wetland is classified from aerial photographs based on existing vegetation, visible hydrology, and geography. NWI maps are available from the Vermont Wetlands Office (see below) and from town clerks. Information about the USFWS's classification system can be found on the National Wetlands Inventory website (<http://wetlands.fws.gov/>), or in the book *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Digital data can be obtained from the website.

- ▶ **Wetlands Section, Vermont Department of Environmental Conservation:**

This program regulates wetlands in Vermont, maintains NWI maps for the state, and provides technical assistance on wetland identification, delineation, and protection through planning and other mechanisms. It also is a source of information on the functions, values, and locations of wetlands throughout the state. Contact this office for maps of wetlands throughout Vermont.

- ▶ **Vermont Fish and Wildlife Department:**

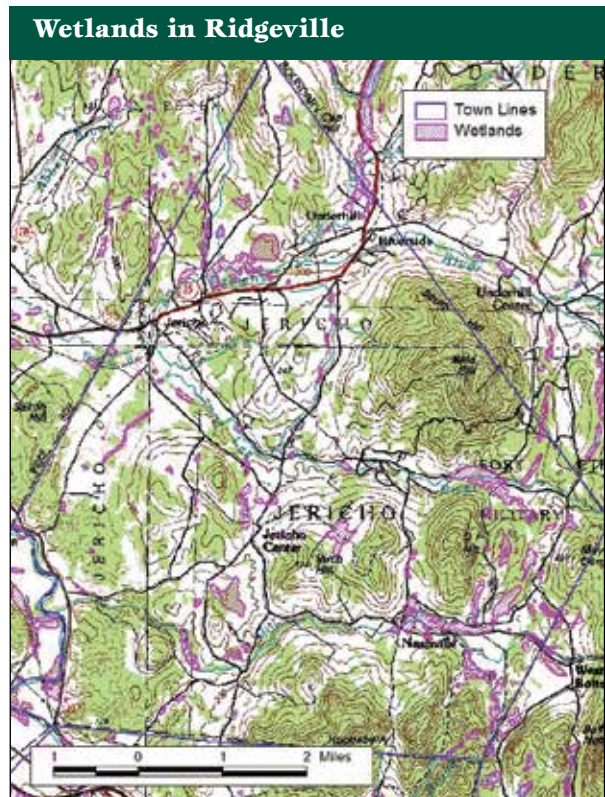
The Department prepares maps that depict significant wildlife habitats, including wetlands, to assist towns with conservation planning. In some cases, Department staff can assist towns in assessing the importance of a particular wetland as wildlife habitat, as a significant natural community, or as habitat for rare, threatened, or endangered species.”

- ▶ **Local and Regional Planning**

Commissions: Commissions have significant habitat maps from the Vermont Fish and Wildlife Department.

- ▶ **Vermont Center for Geographic**

Information: The Center maintains a digital NWI data layer.



Map 4-2 (Source: Vermont Fish & Wildlife Department – Everett Marshall and Kevin Viani)

Gathering New Field Data on Wetlands

Although the National Wetlands Inventory is available for all areas of Vermont, the maps are incomplete because they were made using aerial photographs at a very small scale, without any on-the-ground inventory. A more detailed assessment will likely reveal more wetland areas and more accurate wetland boundaries than were identified by NWI. One Vermont town, for example, commissioned a local study of wetlands and identified nearly double the wetland acreage that had been previously identified by NWI. The quality of this new information has allowed the town to plan confidently for the stewardship and/or protection of its wetland resources. The methodology for identifying new wetlands is the same as for mapping natural communities and can be done along with that work.



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Interpreting the Information

Although the most comprehensive source of information on wetlands is the NWI, this information should be used with caution. The maps were prepared using aerial photography rather than field inventory, so wetlands that are hard to see on aerial photos are not mapped. Many forested wetlands, for example, are not on NWI maps. Understanding the functions and values of each wetland requires field inventory and assessment by a natural resource professional. (The Vermont Department of Environmental Conservation's Wetland Program and the VFWD can help in some cases.) This is important because wetland conservation measures must be assessed on a case-by-case basis in the field. For instance, wetlands that provide habitat for breeding and nesting waterfowl or for wading birds may require a wide undisturbed buffer (e.g., 300 feet) to adequately ensure that the habitat functions will be maintained.



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Conservation Strategies

Once information has been gathered on wetlands, you can develop specific conservation strategies to help achieve your goals. Examples of strategies for each goal are presented below.

1. Goal: Provide for long-term stewardship of or protect wetlands that have significant functions and values for rare species habitat, wildlife habitat, or natural communities and prevent additional loss of wetlands within the town.

Strategies:

a. Include specific language in the town plan supporting the long-term stewardship or protection of wetlands. **Sample Language:** *Wetlands will be protected from encroaching development, including roads and driveways, and disturbances harmful to wetland-dependent wildlife by restricting development and specific activities in wetlands and by maintaining and/or establishing undisturbed, naturally vegetated buffers around their edges.* See the 1997 Agency of Natural Resources' publication *Local Planning and Zoning Options for Wetland Protection* for more examples of language protecting wetlands in the town plans and other planning and zoning strategies for wetlands.

b. Conduct an inventory of wetlands in town to verify NWI wetlands and document other wetlands not on the NWI maps.

c. The Vermont Wetland Rules allow for wetlands that do not appear on the National or State Wetland Inventory (SWI) maps to be reclassified to Class II or I. This process allows citizens to petition the Agency of Natural Resources to reclassify wetlands not on the SWI maps to Class II (significant) designation so that they are regulated under the Vermont Wetland Rules. For wetlands that have outstanding functions and values a community could consider a petition to the ANR to reclassify them to Class I. Be aware that this is a significant undertaking requiring a great deal of information and site assessments. In addition, reclassification of wetlands presents regulatory implications to private landowners that the community should be aware of. More information on wetlands reclassification is available by contacting the Vermont Wetlands Office (Department of Environmental Conservation) (See Appendix for contact information.)

d. Locate existing wetlands that provide high quality wildlife habitat throughout the town or area of interest using GIS, paper maps, and other wildlife-use data. Trained professionals can also help you evaluate the wildlife habitat functions of a particular wetland. Target these high quality wetlands in open space planning and land acquisition programs. Give higher priority to those wetlands that contain other natural heritage elements such as significant natural communities or rare species.

e. Create a wetlands overlay district, including all wetlands and their buffers of a designated width, as part of town zoning regulations. A minimum buffer of 50 feet from the wetland edge will protect some wetland habitat functions in many situations. The larger the buffer the more wildlife habitat functions will be provided. A buffer of 100 feet or more will increase protection of wildlife movement areas. Active beaver ponds may need buffers up to 400 feet wide to assure continued food supplies for the beaver colony. The overlay district will provide the most protection to wetlands if development is prohibited within it and secondary activities (such as recreation) are limited and carefully implemented.

f. Allow for PUDs in the town zoning and/or subdivision regulations as an alternative to conventional subdivisions, and require, or provide incentives (e.g., density bonuses) for, PUD designs that cluster development away from wetlands and their buffers.

g. Plan to locate new roads (both public and private) and driveways such that naturally vegetated buffers are maintained between roads and wetlands. Incorporate into subdivision and zoning regulations minimum setbacks from wetlands of 100 feet or greater for new roads and driveways. Do not allow roads to cross wetlands where other access options are available. If roads must cross wetlands, require the developer to submit a professional hydrological study and road design that will maintain wetland hydrology and minimize effects on wildlife and their habitats. For example, roads across wetlands should contain adequate culverts and/or bridges to maintain wetland hydrology and allow for safe passage of wetland-dependent wildlife, such as amphibians and muskrats, under the road rather than over it. The Vermont Wetlands Office and the VFWD assist with interpreting wetland hydrology and wildlife use evaluations.

2. Goal: Restore and/or enhance the functions and values of wetlands already altered by human disturbance.

Strategies:

a. Develop land management plans for town-owned lands designed to restore and enhance wetland functions. Carefully consider the balance of public use and wildlife habitat needs. Direct public use away from wildlife-sensitive areas and educate the public about wildlife use of town lands.

b. Adopt town road management standards designed to protect wetlands. Roads should be managed to maintain natural vegetated buffers around wetlands and to limit road runoff from directly entering wetlands. Existing roads that cross wetlands should be retrofitted with culverts and/or bridges to restore wetland hydrology and minimize impacts to wildlife and their habitat.

c. Develop a landowner stewardship program to encourage restoration of wetlands and their buffers. Inform landowners about federal cost-sharing habitat restoration programs, such as the U.S. Department of Agriculture, the Natural Resources Conservation Service (NRCS) Wildlife Habitat Incentives Program (WHIP), and U.S. Fish and Wildlife Service's Partners for Fish and Wildlife programs. The Appendix lists contact information for these programs.

Riparian and Aquatic Habitats

Definition

The word “riparian” literally means of, or pertaining to, the bank of a river or lake. Riparian areas are ecosystems comprised of streams, rivers, lakes, wetlands, and floodplains that form a complex and interrelated hydrological system. These ecosystems extend up and down streams and along lakeshores, and include all land that is directly affected by surface water (Verry et al., 2000). Riparian ecosystems are unique in their high biological diversity. They are “characterized by frequent disturbances related to inundation, transport of sediments, and the abrasive and erosive forces of water and ice movement that, in turn, create habitat complexity and variability...resulting in ecologically diverse communities” (Verry et al., 2000).

Throughout this manual, riparian and aquatic habitats are discussed together because they are highly interdependent, thus planning for the conservation of each of them is most effective when they are considered together. Conserving riparian areas is one of the most effective ways of maintaining high quality aquatic habitats.

Importance

Because of the dynamic nature of rivers, streams, lakes, and ponds, riparian areas have a wide variety of plant and animal communities. These communities form an interconnected food web that ranges from tiny microorganisms to bears and humans. This web also includes reptiles and amphibians, plants, waterfowl, songbirds, bats, mink, and otter. Healthy riparian ecosystems give life to all the species that inhabit them, as well as the species that use the lakes and streams near them, including those species that use bodies of water only at certain times during their life cycles, such as during breeding or migration.

Riparian areas are important not only for the plants and animals that inhabit them, but also for what they provide to the waters near them. The downed wood, leaves, and similar organic material that riparian areas contribute to aquatic systems are important components of the food base and habitat structure in Vermont’s water bodies. Mature trees in riparian areas also shade aquatic habitats, which helps to reduce water temperatures. Riparian vegetation is crucial in filtering overland runoff, thus protecting

water quality, and in stabilizing stream banks, thus preventing excessive streambank erosion and sediment buildup in aquatic habitats.

We value riparian areas for the preservation of the life that depends on them, including human life. These ecosystems protect our water quality for drinking and recreation, protect our investments from flood and ice flow damage, and provide for our recreation, education, spiritual well being, and sense of place. Riparian habitats play a critical role in flood resilience. Vermont is experimenting more frequent flood events and maintaining and restoring riparian habitats is important for improving resilience of the land to flooding. Conserving these ecosystems allows them to carry out their many functions, which include

- ▶ protecting water quality and aquatic habitats;
- ▶ providing habitats for terrestrial wildlife, including travel and dispersal corridors;
- ▶ supporting significant natural communities; and
- ▶ protecting channel-forming processes and channel stability.

Despite the numerous functions and values of riparian areas, an estimated 70 % to 90 % of natural riparian vegetation, vital to maintaining the integrity of riparian ecosystems and biodiversity, has already been lost or is degraded due to human activities nationwide (Doppelt et al. 1993). In Vermont, many of our rivers, streams, lakes, and wetlands no longer have functioning riparian areas due to more than 200 years of intensive human use of the land. Planning for and implementing strategies that will conserve or provide long-term stewardship for these vital habitats will slow this trend toward environmental degradation and restore the rich biodiversity associated with these areas.

Conservation Goals

A town or other planning group might adopt goals for the conservation of riparian and aquatic habitats like the ones below.

1. Provide for the long-term stewardship of and/or protect existing high-quality riparian habitat within the town.
2. Increase the number of miles of naturally-vegetated stream bank and lakeshore in town. Natural vegetation should ultimately consist of

native woody plant species, except where natural meadows occur, usually in association with wetlands.

3. Provide for the long-term stewardship and/or protection of existing high quality aquatic features and riparian habitats throughout the town or area of interest.

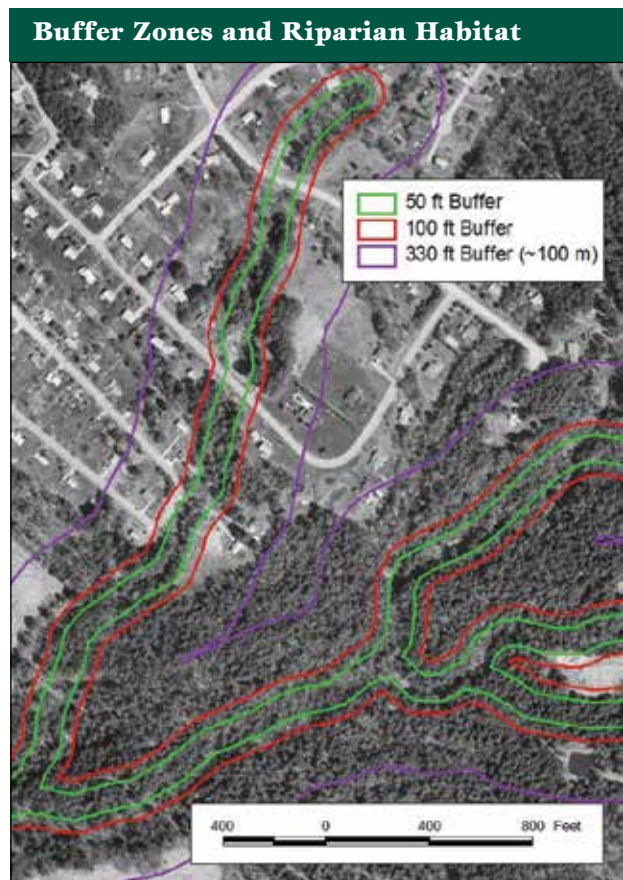
Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **Vermont Center for Geographic Information:** The Center has digital data layers, including orthophotos and surface waters, that can be used to map riparian areas.
- ▶ **Vermont Department of Environmental Conservation, Watershed Management Division:** The Division has a listing of local watershed and lake associations, many of which have undertaken watershed assessments and local inventories of aquatic habitats. The River Management Section of the Watershed Division also manages a statewide database of watershed assessment data, ranging from watershed-wide to site-specific data related to stream geomorphology and riparian and aquatic habitats.
- ▶ **Vermont Department of Environmental Conservation, Water Quality Division:** The Division has a listing of local watershed and lake associations, many of which have undertaken watershed assessments and local inventories of aquatic habitats. The River Management Section of the Water Quality Division also manages a statewide database of watershed assessment data, ranging from watershed-wide to site-specific data related to stream geomorphology and riparian and aquatic habitats.
- ▶ **The Vermont Department of Environmental Conservation and the Vermont Biodiversity Project:** The DEC and the VBP have identified examples of high quality aquatic features throughout the state that represent the best examples of specific aquatic species assemblages. These aquatic features are mapped digitally and are available from the Vermont Center for Geographic Information.

- ▶ **Regional Planning Commissions:** A commission may also have mapped useful watershed or aquatic habitat data and can supply printouts of digital data layers for a fee.
- ▶ **U.S. Fish and Wildlife Service, Partners for Fish and Wildlife Program:** This program provides technical and financial assistance to landowners wishing to restore aquatic habitats.
- ▶ **U.S. Department of Agriculture, Natural Resources Conservation Service:** This agency provides several programs offering technical and financial assistance to agricultural landowners interested in creating and maintaining riparian buffers and other conservation practices.



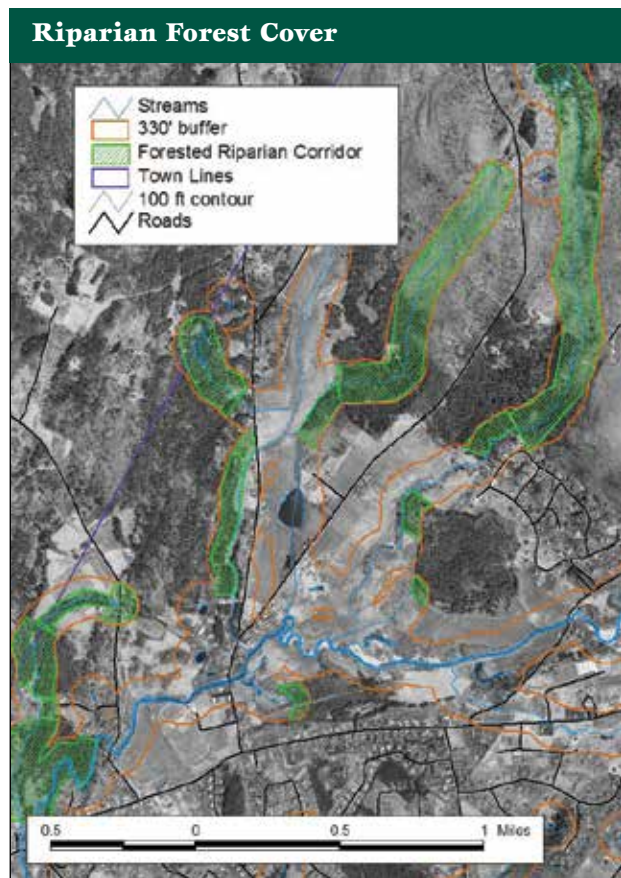
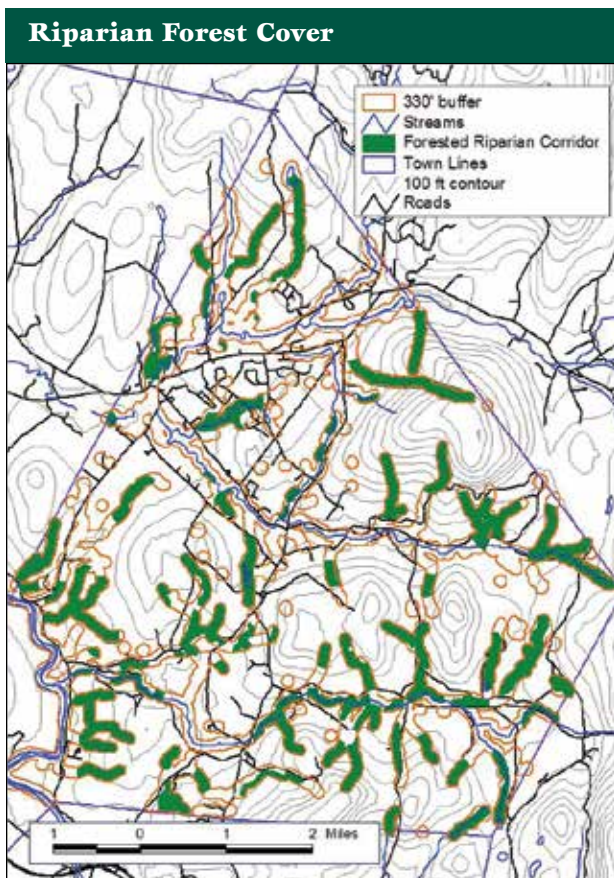
Map 4-3 This map shows standard width buffers of three different sizes, 50', 100', and 330', applied to all surface waters in fictional Ridgeville. Viewing different width buffers on a map enables planners to evaluate how different riparian habitat conservation strategies interact with other town conservation priorities and other planning issues. Standard buffer widths are useful in implementing strategies such as overlay districts, development setbacks, and buffer ordinances.

Mapping Riparian Habitat with Existing Data



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Using GIS mapping software and existing data layers, you can make a digital data coverage of riparian areas. There are two different riparian coverages you can map: 1) standard width riparian buffers, and 2) existing riparian forest cover. These coverages are extremely helpful in implementing the various riparian habitat conservation strategies. If you do not have GIS capability, you can manually delineate riparian areas on topographic maps or printed orthophotos.



Map 4-4 and 4-5

These images show forested riparian areas of a minimum of 330' wide throughout the town, and a close-up of one of these areas with the orthophoto underneath. Orthophotos were used to identify forest cover. Identifying existing forested riparian areas is useful in applying conservation strategies such as acquisition of land or conservation easements, and for understanding where other natural heritage elements, such as connecting habitat, coincide with riparian forest cover. (Source: Vermont Fish & Wildlife Department – Christa Alexander and Kevin Viani)



The photograph on the left shows a large river in a broad valley with a 500-foot-plus floodplain extending from the river's edge into the adjacent meadow and forested hillsides. The riparian area for this large river, if undisturbed, would be composed of floodplain forest extending the width of the floodplain. The photograph on the right shows a small stream in a narrow valley with an effective riparian area less than 50 feet wide that feeds immediately into the forested valley side slopes. (Source: Vermont Fish & Wildlife Department)



Interpreting the Information

Because of its association with bodies of water, riparian habitat can be identified on topographic maps and aerial or ortho photographs. Simply locating a stream, river, or lake on a map is the first step in identifying where riparian habitat may be present in a town. The distance that riparian ecosystems extend from the water's edge into the surrounding uplands varies greatly depending on topography. In general, the larger the body of water, the wider the adjacent riparian area. For example, on a small stream (e.g., 10 feet wide) the effective riparian area may only extend out 50 feet from the stream bank. In a large river such as the Winooski, the effective riparian area may be thousands of feet wide, encompassing wide floodplains that are inundated by water annually. Mountainous headwater streams are usually contained within steep narrow valleys and thus have narrow riparian areas that quickly transition into upland forests. At the other end of the spectrum, large streams and rivers winding through low gradient valleys usually have wide riparian areas that stretch across the entire valley bottom. It is important to understand, however, that even though small streams in steep narrow valleys have narrow bands of riparian habitat, the upland forests surrounding these streams play an important role in protecting the riparian habitat, especially where steep slopes threaten landslides, rapid storm water runoff, and hillside "gulleying."

Your specific conservation goals will dictate how large an area you want to consider for riparian habitat conservation. But in general, a naturally vegetated 100-foot-wide riparian buffer on each side of a stream will protect many of the functions associated with healthy riparian habitat. A 330-foot buffer will protect

nearly all the functions we value in riparian habitat, including high-quality cover for many wildlife species. Because riparian habitat provides many functions important to fish and wildlife resources, it is helpful to understand these areas by the functions they provide. The book *Buffers for Wetlands and Surface Waters: A Guidebook for New Hampshire Municipalities* is a good source of detailed

information about different buffer widths and the species and functions they protect. (See the "Bibliography and Works Cited.")

Conservation Strategies

Once information has been gathered on riparian and aquatic habitats, you can develop specific conservation strategies to help achieve your goals. Some examples of strategies specific to each goal follow.

1. Goal: Provide long-term stewardship of and/or protect existing high-quality riparian habitat within the town.

Strategies:

- a. Include specific language in the town plan supporting the stewardship, protection, and restoration of riparian habitat. **Sample Language:** *Lakes, ponds, rivers, and streams will be protected from encroaching development, including roads and driveways, by maintaining and/or establishing undisturbed, naturally vegetated riparian buffers on their banks.*
- b. Incorporate development setbacks and buffers from surface waters into town zoning regulations. Create a separate zoning district or an overlay district including surface waters and riparian buffers of designated width(s). These districts will provide the most protection to riparian habitat and aquatic resources if all development is prohibited in these areas. A minimum setback and buffer encompassing the 100-year floodplain or 100 feet, whichever is

Thinking Beyond Your Boundaries

The Riparian Connection

Vermont's aquatic habitats range from trickling brooks to huge rivers, and from small ponds to Lake Champlain. All are connected to one another through watershed drainage patterns. Similarly, unlike



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most other habitat types, riparian habitat does not naturally exist in discrete patches across the landscape, but rather is connected from headwaters to ocean along the numerous streams and rivers that drain our landscape. Thus, it is important to recognize the connectivity of riparian and aquatic habitats beyond our political boundaries. The rivers and streams that flow through your town do not stop flowing at the town's boundaries, nor does the riparian habitat end at the town line. Achieving healthy riparian and aquatic ecosystems is best achieved when one considers whole watersheds. Everything occurring upstream of you in the watershed may ultimately affect the quality of natural resources in your town, and downstream

activities can have impacts on your town's riparian and aquatic habitats, too. Thus, it is crucial to work with the towns and other conservation groups active in your watershed when articulating, planning for, and implementing your riparian and aquatic habitat conservation goals.

greater, will protect many riparian habitat functions in most situations. The larger the setback and buffer the more riparian functions will be provided.

c. In addition to the setback of actual structures, secondary activities such as footpaths and other clearing associated with development can be regulated to protect riparian habitat functions. A set of conditions designed to protect riparian habitat can be stipulated through the conditional use determination and/or site plan review processes for those developments that fall under these reviews. (See Chapter 7 for details on conditional use and site plan review.) Specific conditions may include: 1) requiring a riparian vegetation management plan to be approved by an appropriate professional, and 2) requiring the construction of foot paths and other activities that will disturb natural vegetation and ground cover to follow design specifications, including limits on the amount and types of vegetation to be cleared.

d. Map existing riparian forest cover (within 330' wide buffer) throughout the town using GIS or paper maps. Target these forested riparian areas in open space planning and land and easement acquisition programs. Give higher priority to those riparian lands that also contain other natural heritage elements.

Write land management plans designed to protect the ecological functions of riparian habitat (and other natural heritage elements) for town-owned lands.

e. Allow for PUDs in the town zoning and/or subdivision regulations as an alternative to conventional subdivisions, and require, or provide incentives (e.g., density bonuses) for PUD designs that cluster development away from riparian habitat.

f. Adopt town road management standards designed to protect riparian habitat and their associated surface waters. See the Bibliography for resources providing information on road standards designed to protect riparian habitat and surface waters.

g. Plan to locate new roads (both public and private) and driveways such that functioning riparian buffers are maintained between roads and surface waters. Incorporate into subdivision or zoning regulations minimum setbacks from surface waters of 100 feet or greater for new roads and driveways created through subdivisions.

2. Goal: Increase the number of miles of naturally vegetated riparian streambank and lakeshore in town. Natural vegetation should ultimately consist of native woody plant species except where natural meadows occur, usually in association with wetlands.

Shore Land and Floodplain Development

We are drawn to Vermont's lakes and rivers, some of us so much so that we have come to build our homes on their shores and banks. By doing so, in many cases we have destroyed what drew us there in the first place. Not only is this development pattern detrimental to our wallets (as we buy out flooded home owners and pay for riverbank and shoreline stabilization,) but it also threatens the numerous plant and animal species that reside in and around Vermont's lakes and rivers. Development of Vermont's lakeshores, in particular, has a long history, and fixing the jumble of many decades of development on these fragile habitats is not an easy task. State statute 24 V.S.A. Chapter 117 §4411 allows towns to regulate shore lands for several purposes, including wildlife habitat protection. Where development has yet to occur on lakeshore and riverbanks, there is a unique opportunity to direct careful development and/or set aside open land for the benefit of the public and the wildlife resources that rely on shoreline habitats and the adjacent waterbodies they protect. There are many strategies, from zoning to land acquisition to tax incentives, that can be used to protect shorelines, floodplains, and other unique aquatic features in Vermont – but they all require planning!



Strategies:

a. Require restoration of riparian habitat in site plan or subdivision review. Riparian restoration can be accomplished through site plan review by designating “no-mow” zones along surface waters within the project site, allowing for natural regeneration of woody vegetation, and/or by requiring active planting of native woody species in the riparian area. This strategy applies to development projects occurring on lands that contain previously degraded riparian habitat, commonly found on former farmland. See “Bibliography and Works Cited” for resources on riparian planting restoration techniques. **Sample Language:** *The Development Review Board shall require restoration of degraded riparian habitats through natural regeneration of native riparian vegetation by designating “no mow zones” and/or by planting native woody plant species appropriate to the site in “planting zones.” The developer shall guarantee plantings with a performance bond for a minimum of five years. No-mow zones and planting zones shall be described and designated as protected riparian habitat in common-land covenants, easements, and other appropriate legal documents. This language will require a definition of “riparian habitat” and “degraded.”* **Sample Language:** *Riparian habitat is naturally vegetated land adjacent to surface waters, extending from the ordinary high water mark (or top of bank) of a surface water into adjacent upland communities. Degraded riparian habitat contains sparse or no native woody plants above ordinary high water (or top of bank), is largely absent of*

Shelburne Pond, for example, located in the most populous county in Vermont, will remain a high quality pond and wetland complex, protected in perpetuity by a few motivated citizens and a regional conservation organization. This pond now serves as a unique natural area and a functioning wetland ecosystem in an otherwise rapidly developing area. (Source: Vermont Fish & Wildlife Department – Christa Alexander)

a duff layer, and is either devoid of all vegetation or has only herbaceous vegetation that is typically fallow field, lawn, garden, crop, or pasture. An example of a riparian area dominated by herbaceous vegetation and not considered degraded is where wetlands containing native herbaceous plants are present within the riparian area, and where erosional river bluff natural communities occur, as such areas do not naturally support woody vegetation.

b. Initiate an impact fee and use the collected fees to manage town open space lands, forests, parks, or recreation areas, including restoration of riparian areas (or other natural heritage elements).

c. Allow for PUDs in town zoning regulations as an alternative to conventional subdivisions, and require or provide incentives (e.g., density bonuses) for PUD designs that cluster development away from riparian habitat and *actively restore* degraded riparian habitat.

d. Offer density bonuses to subdivision developments that actively restore and protect riparian habitat by means of conservation easements or common-land designations with specific conditions intended to restore and/or protect riparian habitats. **Sample Language:** *Density bonuses can be earned for riparian habitat conservation at the rate of X units for every X square feet (acres) of riparian habitat protected and, where necessary, restored with native woody vegetation. To be eligible for a density bonus, the riparian area conserved must be a minimum of 100 feet wide, extending out perpendicular from the surface water's top of bank, and must extend along the body of water for a minimum of 500 feet or the length of the parcels under review, whichever is smaller. Land beyond 600 feet from the top of bank does not count towards the density bonus. Riparian habitat protection must be guaranteed by means of an easement or covenant. Degraded riparian areas currently lacking woody vegetation shall be restored with native plant species appropriate to the site. Restoration work shall be bonded to ensure success of the plantings for five years, to commence upon the completion of all required riparian restoration planting.*

e. Work with local watershed associations, conservation commissions, and Natural Resource Conservation Districts to assist landowners in restoring riparian habitats on their lands. Assistance includes informing landowners about federal riparian restoration cost-sharing programs (such as the USDA Natural Resources Conservation Service (NRCS) Wildlife Habitat Incentives Program (WHIP) and USFWS Partners for Fish and Wildlife programs), organizing volunteers to plant trees, raising outside funds to help with cost-sharing matches, and educating about the importance of riparian habitat.

3. Goal: Provide for long-term stewardship and/or the protection of existing high quality aquatic features and riparian habitats throughout the town or area of interest.

Strategies:

a. Include specific language in the town plan supporting the protection of priority aquatic features and overall aquatic habitat. **Sample Language:** *Lakes, ponds, rivers, and streams will be protected so as to maintain their natural conditions. Stream channels and lakeshore alterations will be restricted, removal of large woody debris from channels and shorelines will be discouraged, and naturally vegetated riparian buffers will be protected and/or restored on streambanks and lakeshores.*

b. Target the high-quality aquatic features identified by the Vermont DEC and VBP in open space planning and land and easement acquisition programs. Ensure protection of these resources and other high quality aquatic habitats identified in your area through long-term stewardship, easement conditions, and land management plans that include the following:

- ▶ Designate naturally vegetated riparian buffer zones;
- ▶ Educate landowners to leave large woody debris from stream channels and lakeshores or implement restrictions;
- ▶ Prohibit channelization, dredging, filling, or other activities altering the natural form and function of stream channels and lakeshores; and
- ▶ Limit stream crossings as much as possible and require stream crossing to be properly sized and installed so as not to disrupt or prevent aquatic species' movements and to maintain the natural form and function of the stream channel.

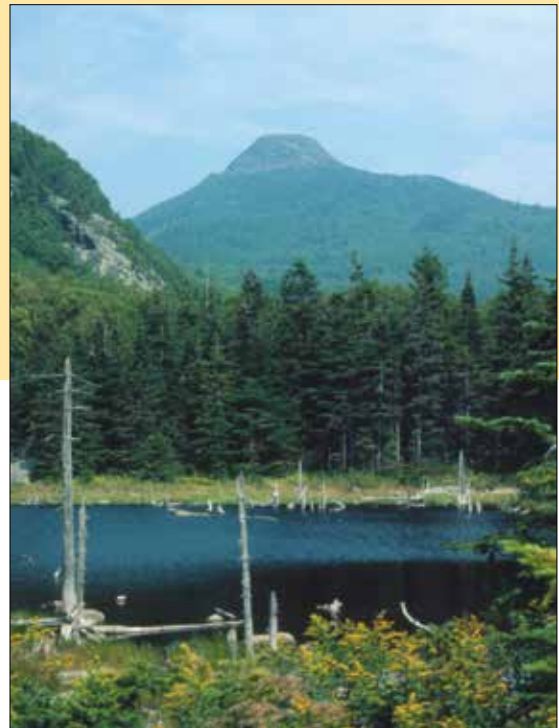
c. Using subdivision regulations, PUDs, conditional use, or site plan review, direct developers to maintain stream channels and lakeshores in their natural condition. **Sample Language:** *Activities that alter the natural form and function of a surface water, such as filling, dredging, damming, channelization, removal of riparian vegetation, and removal of large woody debris, shall be prohibited in all developments subject to review by the Zoning Development Review Board. Furthermore, all zoning permits (including conditional use permits and subdivision approval) will be issued on condition of the developer submitting proof of compliance with all applicable state and federal regulations pertaining to surface waters, including, but not limited to: Section 404 Clean Water Act, Section 401 Clean Water Act, 10 V.S.A Chapter 47 Vermont Water Pollution Control Act, 10 V.S.A Chapter 41 Regulation of Stream Flow, 10 V.S.A 43 Dams, 10 V.S.A. Chapter 111 Section 4607 Obstructing Streams, and 10 V.S.A. Chapter 151 Vermont's Land Use and Development Law (Act 250).* This or similar language can be incorporated into a riparian and surface water overlay district, or can be part of a stand-alone town zoning ordinance.

Shore Land and Floodplain Development

State statute 24 V.S.A. Chapter 117 Section 4412 (Regulation of Flood Hazard Areas) sets forth provisions for a local floodplain regulation, intended to protect lives and property within the floodplain and make the community eligible for National Flood Insurance. The National Flood Insurance Program (NFIP) (administered by the Federal Emergency Management Agency) produces a series of flood area and flood hazard maps that towns may use to adopt floodplain regulations. These maps contain various flood hazard assessments and, in general, depict the boundaries and elevation of the 100-year flood at the time of map production.

These maps were originally produced in 1974-1975, and most towns in Vermont have maps dating from at least 1980 available. In many cases even a 1980s map is largely outdated, especially in areas that have recently experienced substantial development in and around floodplains. If NFIP maps are used as a surrogate for mapping riparian areas, one should recognize that the maps do not identify current riparian area condition and are based solely on land elevation measurements that delineated the 100-year floodplain at the time the maps were produced.

In addition to the NFIP maps, it is recommended that the meander belt-width of rivers be incorporated in river and floodplain zoning districts to allow for the natural channel meander migration and ecosystem functions of river systems. The meander belt-width of a river is defined as the distance between lines drawn tangential to the extreme outer limits of fully developed river channel meanders. In general, the meander belt-width represents the width of valley that a river channel needs to carry out natural meander migration processes over time, and typically is six times the width of the active (or bankful) channel. See the Vermont Stream Geomorphic Assessment Phase 1 handbook (listed in the Bibliography) for a full discussion of river belt-width and how to map it. Also refer to the ANR “Technical Guidance for Determining Floodway Limits Pursuant to Act 250 Criterion 1(D)” for detailed information on how to incorporate river erosion hazard potential into floodway regulations. NFIP maps are available for some counties in digital format at the VCGI website and from the regional planning commissions.



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Vernal Pools



Definition

Vernal pools are small wetlands characterized by a lack of vegetation (though they may support some herbaceous wetland species) resulting from the persistence of standing water for a portion of the year. Vernal pools typically occur in small depressions in upland forests over a relatively impermeable substrate layer, but they also may be found in the depressions of some forested swamps. Although pools often lack woody vegetation, they are typically well shaded by the surrounding forest canopy. In the Northeast, many vernal pools start filling with the fall rains, retain water, ice, and snow through the winter, and collect more water with spring rains and snowmelt. They may also be influenced by rising groundwater in the fall and spring. The pools typically lack inlets and outlets, with the possible exception of outflow following heavy spring rains. A pool may be dry by mid-summer or may retain its water throughout the year in some wet years.

Importance

Vernal, or temporary, pools are perhaps best known as important breeding habitat for amphibians. Typical Vermont species that rely on vernal pools for reproduction include the mole salamanders (Spotted salamander, Blue-spotted salamander, and Jefferson

salamander), Eastern four-toed salamander, and wood frog. All of these species may breed in other wetlands, including artificial pools and ponds, but rely heavily on vernal pools to maintain their populations. For vernal pools to be effective breeding habitats for amphibian populations, they must retain water for at least two 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 pools as well, such as fairy shrimp, fingernail clams, snails, eastern newts, green frogs, American toads, spring peepers, and a diversity of aquatic insects. Fairy shrimp are thought to be restricted to these temporary pools. The amphibians and invertebrates found in vernal pools constitute a rich source of food for various species of birds, mammals, and reptiles that may be attracted to the pools. Wood ducks, mallards, black ducks, and great blue herons are occasionally known to feed at these pools. Despite their small size and temporary nature, vernal pools are highly productive ecosystems.

Vernal pools and the organisms that depend on them are threatened by activities that alter pool hydrology and substrate, as well as by significant alteration of the surrounding forest. Construction of roads and other development in the upland forests around vernal pools can result in negatively affecting

salamander migration and in mortality (Forman, et al., 2003). Timber harvesting can have significant effects on vernal pools, including alteration of the vernal pool depression, changes in the amount of sunlight, leaf fall, and coarse woody debris in the pool, and disruption of amphibian migration routes by the creation of deep ruts. Even when the pool is dry, alteration of the depression substrate may affect its ability to hold water and may disrupt the eggs and other drought-resistant stages of invertebrate life that form the base of the vernal pool food chain.



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Spotted salamander is one of several amphibians that requires vernal pool habitat to lay eggs and produce young.

Conservation Goals

A town or other planning group might adopt goals like the ones below for the conservation of vernal pools.

1. Provide for the long-term stewardship and/or protection of vernal pools and associated amphibian populations.
2. Provide for the long-term stewardship and/or protection or restoration of forested habitat between pools to provide dispersal corridors for dependent species, particularly amphibians.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- **The Vermont Fish and Wildlife Department's Natural Heritage Inventory:** This program has limited information on vernal pools and rare amphibian occurrences. Call the Department for information on known vernal pool occurrences.

Gathering New Information on Vernal Pools

Information regarding the distribution of vernal pools in Vermont is limited and further study is needed to better understand this natural resource. Use of large-scale, color infrared aerial photography is currently the most accurate, efficient, and widely accepted method of predicting vernal pool presence on a landscape scale (Burne, 2001). Amphibian surveys may be useful in locating some pools. In early spring, frogs and salamanders can often be found crossing roads in search of vernal pools and wood frogs can be heard calling from a breeding pool.

State agencies or conservation organizations in Massachusetts, Maine, and New Hampshire have launched citizen-based vernal pool inventories and produced valuable handbooks on the techniques. The Vermont Center for Ecostudies (VCE) promotes citizen science including vernal pool inventories and "calling frog" surveys. We recommend studying some or all of these before embarking on your own inventory.

The Department is developing a consistent vernal pool inventory protocol; check on the status of this protocol before starting a vernal pool inventory. We encourage those undertaking vernal pool inventories or amphibian surveys to contribute records to the Vermont Reptile and Amphibian Atlas, a repository of documentation of reptile and amphibian sightings throughout Vermont as well as a source of information and inspiration to those interested in herpetile conservation. For information about these organizations and agencies see Appendix. Mapping vernal pools allows you to analyze their distribution in relation to the surrounding natural and human environment and visualize conservation opportunities and limitations. While GIS mapping is recommended, using USGS topo maps or other similar maps is acceptable.

- **Citizens:** People who work in the woods or who spend recreational time there often have a wealth of information on a variety of natural resources. Hang posters around town soliciting information. Host a public meeting to solicit local knowledge about this resource or set up a display in the local library asking residents to share information.

Interpreting the Information

Management planning that protects populations of pool-specialist amphibians must recognize the importance of their terrestrial habitat as well as the breeding pool. The area used by a population year round can be represented by three management zones: the breeding pool, a 100-foot zone around the pool, and a third zone that extends an additional 500 feet (600 feet from the pool edge).

Breeding Pool — This area includes the pool depression measured at spring high water. It is important to note that the pool may not be entirely full or may even be completely dry during part of the year. At such times, the high water mark must be determined using such evidence as water marks on trees within the depression, water-stained or silted leaves, or an obvious change in topography at the pool edge. **Management recommendations:** *No disturbance should be introduced to the breeding pool.*

100-foot Zone — Within this zone, pool-breeding adults and juveniles emerging from the pool can occur at high densities at critical times of the year. This zone also protects water quality and habitat by providing shade to the forest floor and pool, filtering runoff, providing root tunnels, and supplying leaf litter and woody debris to the pool. **Management recommendations:** *Avoid clearing of land or permanent development including roads and driveways, changes in water quality or hydrology (including no use of pesticides), and barriers to amphibian movement. Some studies recommend maintaining or establishing a forested condition with at least 80% canopy cover.*

600-foot Zone — This zone represents the majority of the important terrestrial habitat needed by these species during most of the year (Semlitsch, 1998; Faccio, 2001). Recent studies indicate that at least this much area around the pool is needed to protect 95% of adults in mole salamander populations. Faccio found that females move farther than males and other studies indicate that average distances of movement for mole salamanders and juvenile wood frogs can go well beyond 600 feet from the pool.

Vernal Pools in Ridgeville

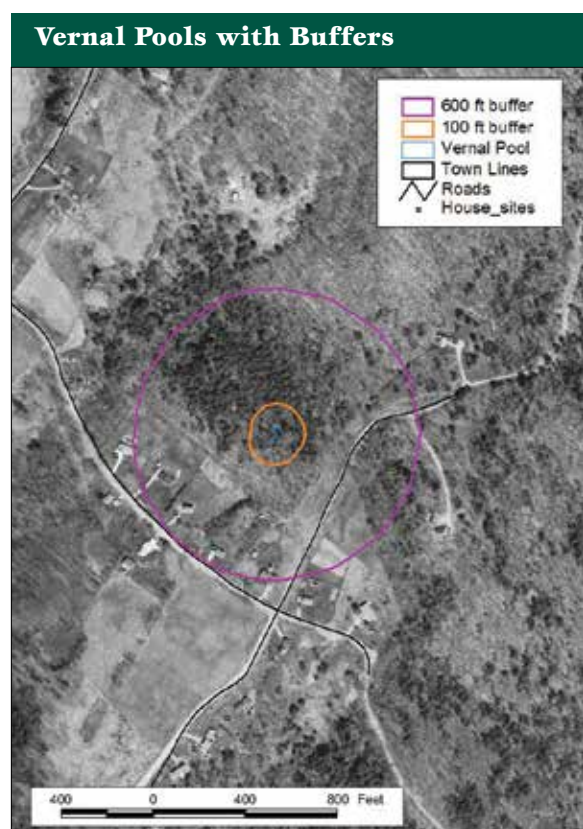


Map 4-6

When all of the existing information about known pools has been assembled and new locations identified, the distribution map of vernal pools in your town may look like this. (Note: These are not actual known locations of vernal pools, but a fictional scenario developed expressly for demonstration purposes.) (Source: Vermont Fish & Wildlife Department – Everett Marshall and Kevin Viani)

Management recommendations: *Attempt to retain this area in a forested condition on greater than 75% of the area with at least 60% canopy cover (composed of trees at least 25 feet tall), maintaining a moist forest floor with deep litter and abundant coarse woody debris. Avoid establishing new roads and driveways that will carry more than very light traffic (5-10 vehicles per hour) within this area of habitat. Where existing roads are known to bisect amphibian habitat and cause mortality, it may be advisable to explore methods that can help reduce this result (for example, wildlife passage structures). Avoid creating ruts and other artificial depressions that hold water, as these may attract breeding amphibians but do not provide suitable habitat for developing larvae. Avoid clearing steep slopes that contribute runoff into breeding habitat. Employ erosion control methods to prevent sediment and pollutants from entering breeding habitat during and after clearing and construction, but minimize use of silt fencing within*

600 feet of a breeding pool, as these can interfere with amphibian migration to and from breeding habitat. 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.



Map 4-7 This map, created with GIS software, shows 100-foot and 600-foot zones around a vernal pool, which are critical to pool-breeding amphibian habitat. The section of road shown here within the circle serves three single-family homes and poses limited mortality risk to migrating and dispersing amphibians. With very light traffic (5-10 vehicles per hour) and < 25% of the 600-foot zone developed, this configuration of houses, road and driveways meets recommendations for conserving pool-breeding amphibians found in the literature. However, as discussed throughout this document, the dispersed pattern of development shown here does not further the goals of conservation planning in general. (Source: Vermont Fish & Wildlife Department – Everett Marshall and Kevin Viani)

The following examples of conservation strategies may help achieve the related conservation goals for vernal pools in the area of interest.

1. Goal: Provide long-term stewardship of and/or protect all significant vernal pools and maintain associated amphibian populations.

Strategies:

a. Use information gathering, mapping, and inventory work to learn the location of all the vernal pools in your town. Solicit the help of a qualified wildlife biologist or herpetologist to assess amphibian populations at the pools, which may help you prioritize pools for further stewardship, protection, and/or restoration strategies. Keep in mind, however, that the absence of amphibians in any single year does not necessarily indicate that a pool is not valuable. For an accurate assessment of amphibian use of the habitat, surveys should be conducted over several years. Vernal pools lacking amphibian populations may still support other organisms such as fairy shrimp and fingernail clams, and may be worthy of conservation as well. Secure proper landowner permission before initiating any surveys.

b. Inform landowners of the locations of vernal pools on their property, the habitat needs of the associated amphibians, and how they can protect these pools and the amphibians using them. Develop a stewardship program to help landowners manage pools. Secure proper landowner permission before initiating any surveys.

c. Include a vernal pool map in your town plan and emphasize the importance of conserving them.

Sample Language: *Vernal pools will be protected from encroaching development, including roads and driveways, by retaining and/or establishing adequate forested habitat around all vernal pools in town.*

d. Establish an overlay district that identifies vernal pools and their surrounding terrestrial amphibian habitat. To be most effective, this district should provide a large buffer surrounding the pool in which no development is allowed and other ground-disturbing activities are limited. Current literature indicates the need for a 600-foot habitat zone around high quality vernal pools. Recognizing the large area this zone represents, it may be advisable to determine habitat protection on a case-by-case basis. Development projects in this zone should be sensitive to the vegetation in this area. Other strategies, such

as reducing the road width standards or prohibiting vertical curbing, could be employed in the overlay district to lessen the effect on amphibians. Although conditional use and site plan review can be used within the overlay district to regulate activity around vernal pools, these are less effective strategies than restricting development around vernal pools altogether. For recommendations on protecting pool-breeding amphibian habitat, refer to Calhoun and Klemens (2002) or contact the Vermont Fish and Wildlife Department.

e. Target vernal pools in open space planning and land acquisition programs. Pools associated with other natural heritage elements and pools of particularly high quality should be given higher priority.

f. Allow for PUDs in the town zoning and/or subdivision regulations as an alternative to conventional subdivisions and require, or provide incentives (such as density bonuses) for PUD designs that cluster development away from vernal pools and their surrounding terrestrial amphibian habitat.

Note: A 600-foot zone around even the smallest vernal pool will cover about 26 acres.

g. Plan to locate new roads (both public and private) and driveways such that adequate terrestrial habitat is maintained between roads and vernal pools. Incorporate into subdivision or zoning regulations minimum setbacks from vernal pools of 600 feet or greater for new roads and driveways created through subdivisions. All road designs should avoid increasing runoff to, or changing the hydrology of, vernal pools and other wetlands.

h. Seek to reclassify highly significant pools as Class II wetlands so that they are protected by the Vermont Wetland Rules. More information on wetlands reclassification is available by contacting the Vermont Wetlands Office (Department of Environmental Conservation) or the Water Resources Board. See Appendix for contact information.

i. Write land management plans for town-owned lands designed to protect the ecological functions of vernal pools (and other natural heritage elements).

2. Goal: Provide for the long-term stewardship of, protect, and/or restore forested habitat between pools to provide dispersal corridors for amphibians.

Strategies:

a. Use vernal pool distribution map(s), tax maps, and aerial or ortho photos to visualize opportunities for maintaining or creating connections between pools. These connections are vital to sustaining healthy populations of pool-breeding amphibians by allowing for dispersal of individuals and genetic exchange. Existing forested connections between pools should be considered high priority for protection.

b. Include a vernal pool map in your town plan showing possible dispersal corridors between pools and emphasize the importance of conserving them. **Sample Language:** *Vernal pools and pool-breeding amphibian populations will be protected from encroaching development, including roads and driveways, by maintaining and/or establishing adequate forested habitat around all vernal pools in town. Dispersal corridors connecting adjacent pools will be protected to ensure long-term viability of amphibian populations.*

c. Target high priority corridors through open space planning and land and easement acquisition programs to ensure long-term conservation of dispersal corridors.

d. Develop stewardship programs for private landowners and use certification programs for foresters to encourage management of forested lands in a manner compatible with pool-breeding amphibian conservation.

e. Write management plans for town forests that incorporate these practices as policy.

CHAPTER 5



Species-Level Elements



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The elements in this chapter require special attention because they are not necessarily protected or properly represented through either landscape-level or natural community-level conservation. Seven elements are discussed: **rare, threatened, and endangered species; deer winter habitat; mast stands; important bat habitat; important turtle habitat; grassland bird habitat; and early successional forest and shrub habitat.**

These are discrete significant habitats for fish, wildlife, and plants and are necessary for the survival of those species that rely on them.

It is critical to include these habitats in any conservation planning efforts where they occur.

Rare, Threatened, and Endangered Species

Definition

A rare species is one that has only a few populations in the state and that faces threats to its continued existence in Vermont. Rare species face threats from development of their habitat, harassment, collection, and suppression of natural processes, such as fire. The Vermont Fish and Wildlife Department uses a ranking scheme that describes the rarity of species in Vermont. The range is from S1 (very rare) to S5 (common and widespread). Species are assigned a rank based on the number of known examples, the population size, and the degree to which the populations are threatened. For example, creeping juniper and lake sturgeon are S1 species, whereas sugar maple and raccoons are S5 species. Using this system, VFWD biologists and other experts assign an S1 rank to a species when it may occur in five or fewer populations in the state and/or when the species is threatened with extinction. Rare species with six to 20 populations are given an S2 rank; threats are also considered. Species with 21 to 100 populations are assigned a S3 rank and are generally considered to be uncommon or a watch-list species. (Contact the Department for a complete listing of species and their respective ranks.)

Endangered and threatened species are defined by both state and federal law. State law defines endangered species as “a species listed on the state endangered species list under {10 V.S.A. Chap. 123 section 5401} or determined to be an ‘endangered species’ under the federal Endangered Species Act. The term generally refers to species whose continued existence as a viable component of the state’s wild fauna or flora is in jeopardy.” Threatened species are defined in 10 V.S.A. Chap. 123 section 5402 as a species whose numbers are significantly declining because of loss of habitat or human disturbance, and unless protected will become an endangered species. As of July 2003, there were 195 species of plants and animals in Vermont that are protected by the Vermont Endangered Species Law (10 V.S.A. Chap. 123) and assigned a status of either threatened or endangered. Some of these species that occur in Vermont also have a federal status of threatened or endangered, and are protected by the Federal Endangered Species Act (P.L. 93-205). Any taking, which may include harassment or harm to a state threatened or endangered species, is a criminal offense unless permitted by the Agency of Natural Resources.

(Contact the Vermont Fish and Wildlife Department, or see the Department’s website, for a current listing of threatened and endangered species in Vermont.)

Importance

Rare native species in Vermont, such as Indiana bat, common loon, spiny softshell turtle, goldenseal, and sweet coltsfoot, are an important part of Vermont’s natural heritage. Rare species can play crucial roles in ecosystems, with other species relying on them for their survival. Many of these species are admired and appreciated by people for their beauty, sounds, or mere presence on the landscape. Most of these species in Vermont are rare because they are on the edge of their range or they are separated from the main population by a large distance. For example, the spiny softshell turtle is found in Lake Champlain. The next nearest population is in the St. Lawrence River, but most of the population is found west of New York.

A number of our rare species occur in unique habitat types or rare natural communities, such as Lake Sand Beach or Calcareous Riverside Seep. More wide-ranging animal species, like osprey, are considered rare when their overall populations consist of small numbers of breeding pairs.

Because the planet in general, and possibly Vermont specifically, is experiencing the loss of species at a rate never before experienced in the history of the earth, those species most at risk of extinction, extirpation, and endangerment serve as barometers of the state of the environment (Defenders of Wildlife, 1998). These rare species represent important, arguably the most important, conservation challenges of our time and will serve as indicators of whether the environment that sustains our economies and us



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will persist or perish. Protecting and restoring rare, threatened, and endangered species represents one of the most difficult conservation challenges in Vermont. This is an issue that should be addressed in local, regional, and statewide planning.

Each town harbors its own set of rare and uncommon species that contributes to the overall diversity of the state. Even though Vermont is a small state, it has varied terrain, aquatic systems, elevations, wetlands, geology, and natural communities. All of these factors contribute to the unique assortment of rare species native to Vermont.

Conservation Goals

A town or other planning group might adopt goals like these for the conservation of rare, threatened, and endangered species.

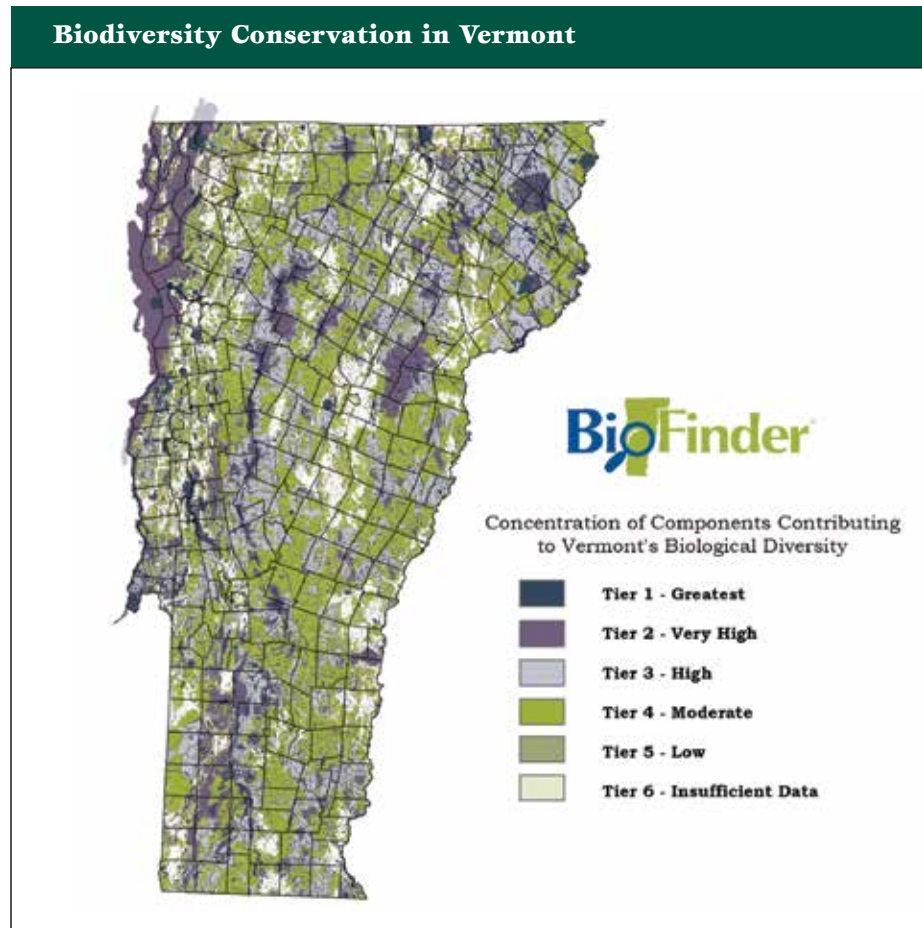
1. Increase populations of rare, threatened, and endangered species in the town or area of interest.
2. Maintain, restore, provide stewardship for, and conserve habitats and natural communities that support rare, threatened, and endangered species.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

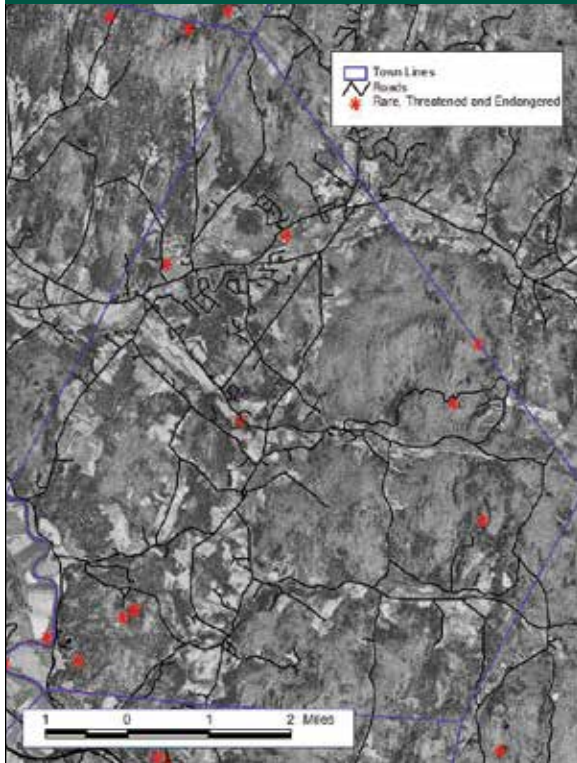
- **The Fish & Wildlife Department's Natural Heritage Inventory:** This program maintains the state's information on rare species. The information management system used is continually updated as inventories are completed and new data becomes available. Detailed map and population information are available for a specific site(s) for planning purposes. Due to the sensitivity of certain species, however, requests for the locations of those listed as threatened and endangered may be considered to be "location confidential," an exception to the Public Records Law, which allows for normal public access to government information.



Map 5-1

This map shows known biodiversity resources. Many unmapped areas have not been studied, and may have significant biodiversity values. (Source: Vermont Agency of Natural Resources. <http://biofinder.Vermont.gov>)

Rare, Threatened, and Endangered Species Ortho in Ridgeville



Map 5-2 (Vermont Fish & Wildlife Department – Everett Marshall and Kevin Viani)

- ▶ **The Vermont Center for Geographic Information:** The Center distributes digital data developed and maintained by the Department’s Nongame Natural Heritage Program.
- ▶ **NatureServe:** This is a national and international database of the network of natural heritage programs that has basic biological and distribution information on many rare species. The database can be found on the Internet at the NatureServe website; select “explorer” on the website.
- ▶ **The Vermont Biodiversity Project:** The VBP has identified “heritage hotspots” — areas where rare, threatened, and endangered species, as well as significant natural communities are concentrated. This data is best used in landscape conservation.



Interpreting the Information

The information sources listed provide two kinds of information on rare, threatened, and endangered species. First, the Natural Heritage Inventory (NHI) and NatureServe both provide general data on each species and its habitat requirements. Second, NHI, and the Vermont Center for Geographic Information offer site-based data on specific locations of rare, threatened, and endangered species.

Species Data – NatureServe, a national and international database, provides information about the distribution and habitat needs of all vertebrates and many other of Vermont’s rare, threatened, and endangered species. NHI is developing guidelines for rare and uncommon species, such as common loon, peregrine falcon, wood turtle, and osprey. In addition, as the Department develops recovery plans for other rare species, planners may find the information and goals established in those plans useful.

Site Data

– Detailed information from the NHI may provide the exact location of a species or an area that it is assumed to inhabit. Field



Bicknell's thrush

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data also may provide a summary of how much of an area around a rare species location was searched. This is especially important if there is appropriate habitat in the vicinity. However, some of the data locations are more general. Standard information in the NHI manual files includes a detailed map, the population size and condition, habitat summary, and a summary of the quality of the occurrence.

Planners should be aware that GIS and significant habitat map point data symbolizing a rare species may represent a small or large population. For example, a mapped point may represent only a few square yards, a large wetland, a river stretch over a mile long, or an extensive ridge top. The specific data in the NHI database may indicate the known range of a rare species as a polygon(s) or multiple points. Specific data also includes threats or management needs noted by the person conducting the field inventory, such as the presence of an invasive species that is affecting a rare species.

Conservation Strategies

Once information has been gathered on rare, threatened, and endangered species, you can develop specific conservation strategies to help achieve your goals. Some examples of strategies for each goal follow.

1. Goal: Maintain or increase populations of rare, threatened, and endangered species in the town or area of interest.

Strategies:

a. Threatened and endangered species are protected by Vermont's Endangered Species Law (10 V.S.A. section 5401 et. seq.). Although the state's Agency of Natural Resources and Fish and Wildlife Department are responsible for the protection and conservation of threatened and endangered species, communities may offer necessary and important support for the legal mandates of Vermont's Endangered Species Law in their town plans. **Sample Language:** *The community recognizes the significant contribution that rare, threatened, and endangered species make to our natural heritage and the health of Vermont's environment. Because of the precarious nature and status of their populations, the community believes that the conservation and protection of the habitats that support these elements of our fish, wildlife, and natural heritage require great vigilance. We therefore will support all*

efforts, pursuant to the state of Vermont's Endangered Species Statute, or through other regulatory and non-regulatory mechanisms, to conserve or otherwise protect those species and the habitats necessary for their continued survival.

b. Provide landowners and resource managers who own or are responsible for the stewardship of lands that support rare species with a map and list of such species on their land. For each rare species, develop management plans with interested landowners or managers. To accomplish this, it may be necessary to secure the services of the Vermont Fish and Wildlife Department or a qualified resource specialist or biologist who can conduct a more detailed inventory of the population status of the plant or animal. Land owner permission is essential prior to conducting any field inventories. The management/conservation recommendations should be based on existing information, discussions with experts, and observation of any threats during the site visit. After consultation with NHI, implement any necessary management/conservation efforts. Monitor the species and adjust management plans accordingly.

c. Establish an overlay district for areas of known rare, threatened, and endangered species and their habitat(s) that prevents development or disturbance of those areas and directs development away from them. The overlay district can require review of any project that takes place within 1000 feet of any



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Calypso orchid, Rattlesnake, Stinkpot turtle, and Adiantum Redatum. Just a few of the rare and endangered species found in Vermont.

mapped point location of rare species and within one mile up or down stream for aquatic species locations. A zoning bylaw could require consultation with the Vermont Fish and Wildlife Department, and a formal written opinion issued by the Department or other appropriate expert. In addition, such a bylaw may require an applicant to provide sufficient information about the species/habitat(s) to understand the full implications of the project to the species/habitat(s) and whether the proposed development is compatible or incompatible with the conservation interests and needs of the rare species and the community's interests therein. The Vermont Fish and Wildlife Department can review this information.

d. Incorporate information about the location of rare, threatened, and endangered species and related habitats into open space and land conservation plans. Target these species' locations and their habitat in open-space planning and land acquisition programs.



© Vermont Fish & Wildlife Department

2. Goal: *Maintain, restore, provide long-term stewardship of, or conserve habitats and natural communities that support rare, threatened, and endangered species.*

Strategies:

a. Initiate an impact fee program and use funds to restore habitats for rare, threatened, and endangered species on town-owned land. Use information on habitat needs of each species to assess whether its habitat is functioning well for the species. If not, develop a natural community restoration plan.

b. Since many rare, threatened, and endangered species are associated with wetland habitats, a town or other organization could consider petitioning for reclassification of any wetlands that support such species to Class I in accordance with the procedures established by the Vermont Water Resources Board and pursuant to the Vermont Wetland Rules. Such reclassification will also serve to enhance protection for myriad other important wetland functions for a community.

c. Incorporate habitats that are important for the conservation and protection of rare, threatened, and endangered species into conservation districts, open space plans, and land acquisition/conservation plans. These areas of overlap should be targeted as high priority conservation zones within a town or area of interest. Conservation easements should be considered especially for lands that support important habitat for rare, threatened, or endangered species.

d. Include a map in the town plan that identifies important locations/habitats for rare, threatened, and endangered species. Indicate that those lands/habitats will be protected for the unique ecological functions they serve and the significant community interests they represent.

Deer Wintering Areas

Definition

White-tailed deer in Vermont live near the northern limit of their range in eastern North America. To cope with Vermont's severe climatic conditions, deer have developed a survival mechanism that relies upon the use, access, and availability of winter habitat. These habitat areas are known as deer wintering areas, deer winter habitat or, more commonly, "deer yards." Deer winter habitat is defined as areas of mature or maturing softwood cover, with aspects tending towards the south, southeast, southwest, or even westerly and easterly facing slopes.

Importance

Deer wintering areas vary in size from a few acres to over a hundred acres and provide essential relief to deer from winter conditions. These areas of softwood cover provide protection from deep snow, cold temperatures, and wind. They provide a dense canopy of softwood trees, a favorable slope and aspect (mentioned above), generally moderate elevation, and low levels of human disturbance in winter. The softwood species that compose these areas are most commonly hemlock and white pine in the southern part of the state, and white cedar, spruce, and fir in the north. Energy loss by deer inhabiting these sites is minimized, and survival is favored in deer wintering areas. Wintering areas do not change significantly between years and can be used by generations of deer over many decades if appropriate habitat conditions are maintained. Deer annually migrate, often several miles, from fall habitats to wintering areas. A single wintering area often serves deer from large areas of a town and in some cases from surrounding towns as well. Residential, commercial, or industrial development within or adjacent to a deer wintering area decreases the amount of winter habitat available to deer and has an effect on an area's deer population, eventually reducing the number of deer within the area. Without adequate winter habitat, northern populations of deer would be subject to extreme fluctuations due to heightened levels of winter mortality during moderate and severe



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winters. Additional information on the winter habitat requirements of deer can be found in the publication *Wildlife Habitat Management for Vermont Woodlands, a Landowner's Guide*, which is available from the Vermont Fish and Wildlife Department.

In addition to benefits for deer, dense softwood stands provide critical winter food supplies for a variety of other wildlife species including porcupines, snowshoe hare, fox, fisher, coyotes, bobcats, crows, ravens, and red and white-winged crossbills to name a few. Other wintering birds routinely find shelter from winds in these conifer stands. Logging can be either detrimental or beneficial to the habitat depending on the harvest method employed and the overall sensitivity shown by the logger and landowner to maintaining these areas of dense softwood cover. Specific management recommendations are given in *Management Guide for Deer Wintering Areas in Vermont*, which is available from the Vermont Fish and Wildlife Department.

Conserving deer wintering areas is essential to maintaining and managing white-tailed deer in Vermont. Deer wintering areas make up a relatively small percentage of the land base of most towns. In fact, only 8% of the forested landscape of Vermont has been mapped as deer winter habitat, so it is not an abundant habitat across the state.

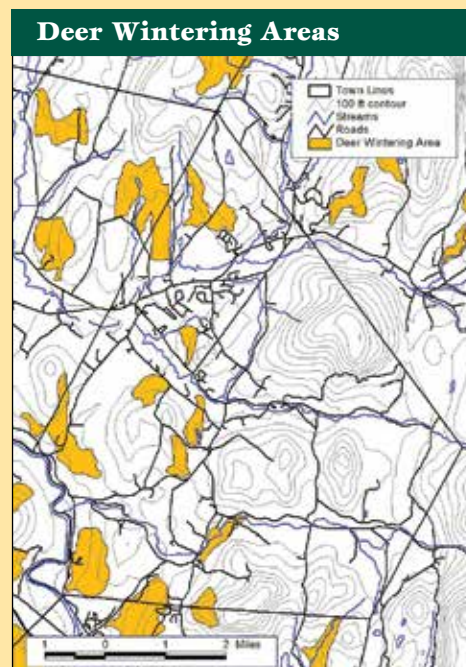
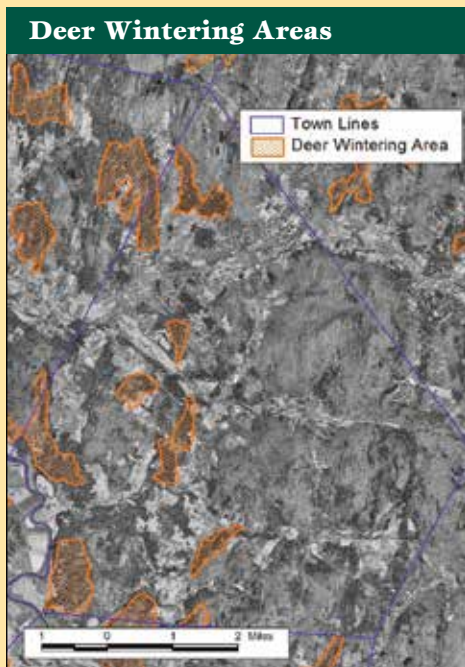
Gathering New Information on Deer Wintering Areas

Physical evidence indicating deer use is the best way to determine whether an area functions as wintering habitat. The most obvious indications of recent deer use include tracks, trails, and droppings. Other less obvious, though very reliable, indicators of deer winter habitat are the more permanent signs of deer use on vegetation, such as evidence of browsing on young trees and shrubs, the presence of an actual “browse line” on taller trees, and bark scarring. Sign of deer browsing activity on young, small diameter twigs and branches should be evident even though the intensity of browsing varies from site to site, between years, and among the different tree and shrub species available. Seedlings and saplings in heavily used areas often have a deformed or “broomy” appearance. The characteristics of heavy browsing on shrubs and trees during the winter, coupled with trails worn into steep slopes and pellet groups made up of dry woody material, allow for positive identification of deer winter habitat even during the summer months. Bark scars caused by deer feeding activity, particularly on hemlock trunks, can be visible to the trained eye for up to 20 years. Delineation of deer winter habitat can be difficult and should be done in consultation with a certified or trained wildlife biologist.



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Supplemental feeding of deer during the winter months is not recommended for a variety of reasons including the risk of spreading diseases and concentrating too many deer in a given area that causes subsequent damage to tree regeneration and the natural vegetation of the forest.



Map 5-3; 5-4 Ridgeville – Deer Wintering Areas and Ortho Map
(Source: Dept. of Fish & Wildlife, K. Viani)

Conservation Goals

A town or other planning group might adopt goals like these for the conservation of deer wintering areas.

1. Maintain and protect the functional integrity of all deer wintering areas within the town or area of interest.
2. Increase the number of deer wintering area acres that are either under long-term stewardship or that are permanently conserved in the town or area of interest.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **Vermont Fish and Wildlife Department:** The Department maintains a GIS database of previously mapped deer wintering areas. These data are updated periodically and were last revised in 2010 through a comprehensive, statewide mapping effort of deer winter habitat. These are available from the VFWD and Vermont Center for Geographic Information.
- ▶ **Vermont Center for Geographic Information:** The Center has a data layer showing currently mapped deer wintering areas.
- ▶ **Local hunters:** People who spend time in the woods are often one of the best sources of up-to-date information on active deer wintering areas



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Interpreting the Information

Most deer wintering areas were originally identified in the 1960s and 1970s using aerial observations, infrared aerial photos, and ground confirmation prior to delineation on USGS 1:24,000 topographic maps. Additional areas are added to the database as they are discovered. It is important to keep in mind, however, that not all deer wintering areas have been mapped. It is also important to remember that some deer wintering areas mapped in the 1960s, 70s, and 80s may no longer exist because of changes in forest cover and changes in land use. Therefore, if you suspect an area serves as deer winter habitat, we recommend you contact the Vermont Fish and Wildlife Department to evaluate the site.

Conservation Strategies

Once information has been gathered on deer winter habitat, you can develop specific conservation strategies to help achieve your goals. Examples of strategies for each goal are presented below.

1. Goal: Maintain and protect the functional integrity of all deer wintering areas within the town or area of interest.

Strategies:

- a. Adopt language in the town plan that protects deer wintering areas, as recommended by the Vermont Fish and Wildlife Department. **Sample Language:** *Deer wintering areas will be protected from development and other uses that threaten the ability of this habitat to support wintering deer. Commercial, residential, and industrial development should not occur within deer wintering areas. Development may be permitted adjacent to a deer wintering area if consultation with the Vermont Fish and Wildlife Department determines that the integrity of the wintering area will be conserved.*
- b. A town plan could reference the Vermont Fish and Wildlife Department's 1999 *Guidelines for the Review & Mitigation of Impacts to White-tailed Deer Winter Habitat in Vermont* and require consideration of the conservation principles established in those guidelines. This could be done in combination with the previous strategy. Free copies of these guidelines are available from the Department.
- c. Locate existing deer winter habitat throughout the town using GIS, paper maps, and other wildlife-use data. Trained professionals can also help you evaluate the extent to which unmapped deer winter habitat exists in the town area of interest. Include deer winter areas in an overlay district that restricts development in and around deer yards.

d. Allow for PUDs in town zoning and/or subdivision regulations as an alternative to conventional subdivisions, and require or provide incentives for PUD designs that cluster development away from deer wintering areas. Adopt language for zoning similar to the following example. **Sample Language:** *Commercial, residential, and industrial development will not be allowed within the bounds of a deer wintering area as shown on the town's deer wintering area map. Development within 300 feet of a deer wintering area will be permitted only if, after consultation with the Vermont Department Fish and Wildlife, it is shown that the integrity of the deer wintering area will be conserved. Note: 300 feet is the minimum distance required to avoid disturbance to wintering deer.*



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The canopy created by softwood trees (e.g., Eastern Hemlock) reduces radiant heat loss, and reduces cooling effect of winter winds. This habitat allows white-tailed deer to survive the harsh winter weather conditions in Vermont.

2. Goal: Increase the number of acres of deer winter habitat that is under long-term stewardship or that is permanently conserved in the town or area of interest.

Strategies:

- a. Target the largest, highest quality deer wintering areas, particularly those that overlap with other natural heritage elements, for land acquisition or conservation easements. Incorporate wintering areas in open space planning and land acquisition programs, giving higher priority to those deer wintering habitats that also contain other natural heritage elements.
- b. Offer density bonuses to subdivision developments that protect and properly manage deer wintering areas by means of conservation easements (refer to riparian strategies, 2d for example zoning regulation language).
- c. Identify interested landowners in the town or area of interest who own or control property that supports deer winter habitat. Work with those landowners/managers to encourage and assist them in developing deer winter habitat management and improvement plans. The Vermont Fish and Wildlife Department offers information and advice for developing such plans.

Mast Stands

Definition

“Mast” is a term commonly used by foresters and wildlife biologists to describe the seeds of shrubs and trees that are eaten by wildlife. “Hard mast” refers to



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Beechnuts are a critical source of highly nutritious food for black bear in Vermont.

nuts (especially those of beech and oaks), whereas “soft mast” refers to berries of a variety of species. Hard mast is generally acknowledged as an important wildlife food

source. In Vermont, 171 species are known to use beech or oak stands as habitat (DeGraaf et al., 1992) including 16 amphibian, 9 reptile, 102 bird, and 44 mammal species. These include species on federal and state endangered/threatened species lists, permanent residents, and migratory birds. These mast stands can occur as discrete stands or patches on the landscape and can be delineated as such (similar to delineating a wetland or deer wintering area).

Beech stands representing necessary black bear habitat are defined as those stands that exhibit bear scarring made within the past 10 years and include at least 15 to 25 scarred beech trees within a stand. Oak stands serving as necessary black bear habitat are those areas that exhibit bear scarring and include at least 15 to 25 oak trees within a stand. Smaller mast stands, however, may also be significant for wildlife and worth considering in local planning.



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A beech tree that has been climbed numerous times over the years by black bears. Notice the consistent claw patterns in the bark. This evidence of bear use persists for many years.

Importance

The reliance of black bear on hard mast has become so well established that the Vermont Fish and Wildlife Department considers areas of beech or oak with a history of bear feeding use to be necessary wildlife habitat as defined by Act 250. A number of studies have documented the relationship between hard mast and bear nutrition. Elowe and Rogers (1989) state that the availability of hard mast in the fall affects the minimum reproductive age of bears, productivity rates, and cub survival. The authors also reported that female bears exhibit reproductive “skips” after poor mast years and that fall weight gains were keyed to mast availability. ***Simply put, these stands of beech and oak used by black bear are absolutely essential for the survival and reproduction of this species in Vermont!***

Mast stands are valuable to a variety of other wildlife and may be irreplaceable on a regional basis. Similar to deer winter habitat and wetlands, significant mast stands are discrete habitat features on the landscape that can be delineated and represented as a polygon on a map. Although American beech, for example, is a common tree species associated with Northern Hardwood Forest natural communities, concentrated stands of beech that are used by



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black bears are not common; they represent a small fraction of the overall forested landscape of the state, hence their significance for conservation planning.

Development within the boundaries of the beech/oak stand obviously directly affects the productivity and bear use of the stand, but even development near a mast stand can diminish the function and use of this habitat. How near a development can be to a mast stand without affecting it depends on topography, vegetative cover, and the nature of the development. This must be evaluated on a case-by-case basis by an experienced wildlife biologist.

Conservation Goals

A town or other planning group might adopt goals like these for the conservation of mast stands.

1. Maintain and protect the functional integrity of all mast stands in the town or area of interest.
2. Increase the number of acres of mast stand habitat that are under long-term stewardship or conserved in the town or area of interest.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **Vermont Fish and Wildlife Department:** The Department maintains a GIS database of previously mapped mast stands that have been demonstrated to be of outstanding value to wildlife. These are available from the VWFD.
- ▶ **Local hunters, wildlife watchers, and landowners:** These sports people spend a lot of time in the forest and are often one of the best sources of information on mast stands.

Interpreting the Information

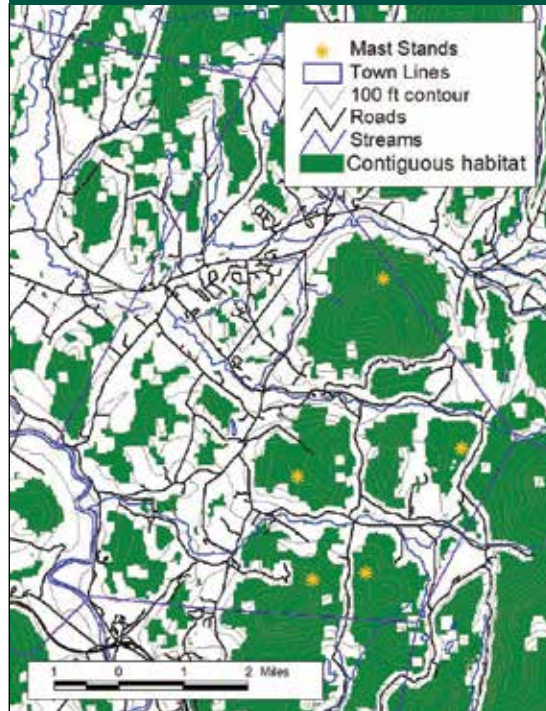
Additional areas are added to the Vermont Fish and Wildlife Department database as they are discovered. Not every mast stand meets the qualifications for listing and mapping as an important mast stand, and not all important mast stands have been discovered and mapped. As previously unidentified mast stands are located, a Department wildlife biologist should be notified and requested to visit the site to confirm the habitat and verify its significance. (Refer to Appendix for contact information)



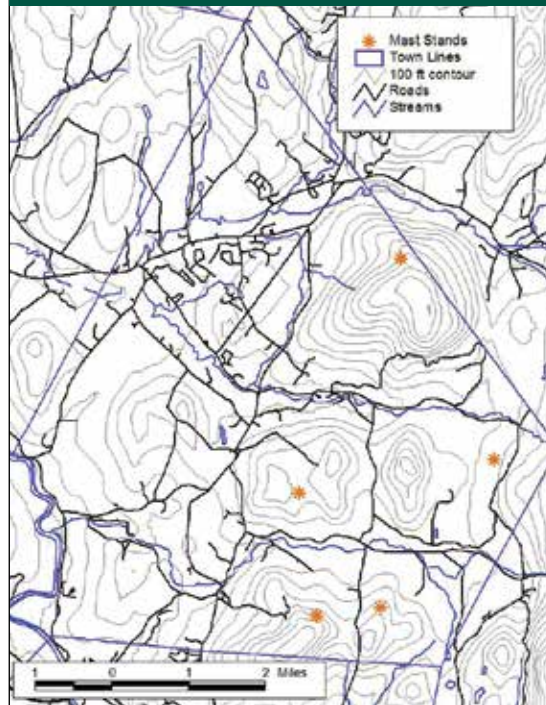
Soft mast, such as cherries, are important food for bears and other wildlife.

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Mast Stands in Ridgeville



Mast Stands in Ridgeville



Maps 5-5 and 5-6

Mast Stands and Ortho. (Source: Vermont Fish & Wildlife Department – Kevin Viani and Everett Marshall)

Conservation Strategies

Once information has been gathered about mast stands, you can develop specific conservation strategies to help achieve your goals. Examples of strategies for each goal are presented below.

1. Goal: Maintain and protect the functional integrity of all mast stands in the town or area of interest.

Strategies:

a. Locate existing mast stands throughout the town using GIS, paper maps, and other wildlife-use data. Trained professionals can also help you evaluate the extent to which unmapped mast stands exist in the area of interest. Target these mast stands in open space planning and land acquisition programs. Give higher priority to those mast stands that are associated with other natural heritage elements such as contiguous forests and connecting lands.

b. Adopt the following language for your town plan:
Sample Language: *Mast stands that have been shown to be important to black bear and other wildlife should be protected from development and other uses and activities that threaten the ability of this habitat to support wildlife. Commercial, residential, and industrial development, as well as certain types of timber harvest activities (large patch cuts or clear cuts) should not occur within the mapped mast stands.*⁶

c. Inform landowners of the locations of mast stands on their property, the habitat needs of the associated wildlife, and how they can conserve these stands to keep them functioning as important wildlife habitat. Develop a stewardship program to help landowners manage mast stands and provide them with information about organizations aimed at assisting them with managing their forests for wildlife habitat. Such organizations include COVERTS, a non-profit program that provides technical assistance to private landowners interested in wildlife habitat improvement, and Vermont Family Forests. (See Appendix)

d. Adopt the following zoning/subdivision regulation:
Sample Language: *Commercial, residential, industrial development, and large clear cuts or patch cuts will not be allowed within the bounds of a mast stand as shown on the town's wildlife habitat map.*

e. Target mast stands in open space planning and land acquisition programs. Give higher priority to those mast stands that are associated with other natural heritage elements, such as contiguous forests and connecting lands.

f. Allow for planned unit developments (PUDs) in town zoning and/or subdivision regulations as an alternative to conventional subdivisions, and require or provide incentives for PUD designs that cluster development away from significant mast stands. PUD approvals can be conditioned with protection for mast stands by means of language required in the development's covenants or a conservation easement.

g. Work with the Vermont Fish and Wildlife Department to determine a suitable buffer width around each known mast stand. In general, these buffers should be at least one-quarter mile and may be as wide as one-half mile, depending on the size and quality of the stand, as well as the characteristics of the surrounding landscape.

2. Goal: Increase the number of acres of mast stand habitat that is under long-term stewardship or conserved in the town or area of interest.

Strategies:

a. Offer density bonuses to subdivision developments that protect and properly manage mast stands by means of conservation easements. (Refer to riparian strategies, 2d for sample zoning regulation language).

b. Identify interested landowners in the town or area of interest who own or control property that supports mast stand habitat. Work with those landowners/managers to encourage and assist them in developing mast stand management and improvement plans. The Vermont Fish and Wildlife Department offers information and advice for developing such plans.

c. This is the same as 1c above. Target the largest, highest quality mast stands, particularly those that overlap with other natural heritage elements, for land acquisition or conservation easements.



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This area is frequently used by black bears to cross a state highway and access important habitat. Notice the dense forest cover leading to a bend in the road.

Important Bat Habitat

Definition

Two distinct habitats are recognized as critical for the persistence of a bat population – winter hibernacula and summer maternity colony habitat (comprised of roosting habitat and foraging habitat). A winter bat hibernaculum is a place — usually a cave or a mine — that provides a constant temperature and protection for winter hibernation. Summer maternity colonies are where female bats congregate to give birth and raise young during the summer. These areas normally are found in trees with exfoliating bark, in tree cavities, and in rock ledges, but may also be found in buildings. Foraging habitat is where bats forage for insects at night.

Importance

North America supports over 45 species of bats, almost all of which feed at night on insects. During a typical night of foraging, a bat may eat as much as one-half its body weight in insects. There are nine bat species in Vermont: The federally endangered Indiana bat, several state endangered bats — the small-footed bat northern long-eared bat, tri-colored bat, and little brown bat — the more common big brown bat, and three migratory tree bats which include the silver-haired bat, red bat, and hoary bat, which are all considered uncommon. Of the nine Vermont species, six hibernate in the region while the three migratory tree bats fly south for the winter. The six hibernating species are all susceptible to White-nose Syndrome, a disease that was discovered in the northeastern US in 2006 and has caused drastic population declines in all but the big brown and small-footed bats.

Winter hibernacula for the six species of bats that over-winter in Vermont are mostly caves and mines. Bats may migrate from great distances to hibernate at these sites. The big brown bat may also hibernate in attics. These sites provide near constant temperatures that are around 40 degrees. Bats go into a torpid state during this period and awaken infrequently. Continued disturbance can waken the bats, depleting necessary energy resources. A few of the larger hibernacula in the region have been gated to prevent disturbance.

Summer colonies are most often found in trees, rock ledges, and buildings. Five of the nine bat species in Vermont form maternity colonies in groups, while others are found individually in trees. Choices for maternity colonies vary by species. Some bat species

prefer trees with a loose bark structure, such as shagbark hickory or older trees. Others, such as the small-footed bat, prefer rock ledges, while the little brown bat and big brown bat are commonly found in buildings.

Foraging habitat for most of Vermont's bat species consists of a relatively open stand below a main canopy. Forest edges, patch connectivity, lakes, streams, and wetlands are all important quality foraging habitat features.

The complete distribution and abundance of significant bat habitat is not yet known in Vermont.

Conservation Goals

A town or other planning group might adopt goals like these for the conservation of important bat habitats:

1. Conserve or provide long-term stewardship of all bat hibernacula in a town or area of interest.
2. Work with other towns to protect regionally important hibernacula.
3. Protect important bat maternity colonies in the town.
4. Protect high quality foraging habitats such as streams, lakes, and ponds.

Obtaining and Interpreting Information

Information Sources

See Resources for information on how to contact or visit the websites of the agencies and organizations mentioned below.

► **Vermont Fish and Wildlife Department:**

The Department has information on some of the important bat cave and mine sites in Vermont. The Department has also been working with the U.S. Fish and Wildlife Service, the U.S. Forest Service, and volunteers in monitoring maternity and roosting colonies for endangered Indiana bats and little brown bats. The Department offers technical assistance for maternity colonies, including those in buildings.

► **U.S. Forest Service:** The Forest Service has site-level information on bat hibernacula and roosting areas.

► **Knowledgeable individuals:** Cavers or bat experts in your town or elsewhere are often the best source of information.

- **The Nature Conservancy:** This organization owns and manages bat hibernacula.
- **Bat Conservation International:** This is a conservation group dedicated to protecting bats and their hibernacula.

Interpreting the Information

Existing information on bat hibernacula may indicate which bat species occur at the site and their relative abundance. This can help assess the importance of a particular cave. Habitat known to house rare, threatened, and endangered bat species should be given priority in conservation decisions.

Conservation Strategies

Once information has been gathered on bat hibernacula and maternity colonies, you can develop specific conservation strategies to help achieve your goals. Some examples of strategies for each goal follow.

1. Goal: *Conserve or provide long-term stewardship for all bat hibernacula in the town.*

Strategy:

Make landowners and resource managers aware of any bat caves or mines in the town. Work with managers to develop cave management plans to protect the bats during the winter months.

2. Goal: *Work with other towns to protect regionally important hibernacula.*

Strategy:

Large bat hibernacula within the region may be critical to bat populations in a town or area of interest. Consider contacting towns and landowners of these hibernacula to develop cave conservation strategies and a cave management plan in consultation with the Vermont Fish and Wildlife Department.

3. Goal: *Protect important maternity colonies and foraging habitat in the town.*

Strategy:

Hold an educational forum on bat conservation and train residents to identify maternity colonies and foraging habitat. An outcome of such efforts may include conservation easements on lands/areas that support these habitats or placement of artificial bat house structures.

Gathering New Field Data on Bat Hibernacula and Colonies

Bat roosting and maternity sites that are located in buildings can be discovered by looking for bats exiting the building at dusk. Locating maternity colonies in trees is more complex and may involve netting bats and radio collaring them. A professional should do this with permits from the Vermont Fish and Wildlife Department. Monitoring cave sites may help ascertain species competition and abundance. However, this must be balanced against impacts to over-wintering bats, and should also be done by a professional. If any of these important bat habitats are discovered, the Vermont Fish and Wildlife Department should be contacted. The Department is responsible for monitoring these important habitats.

Important Turtle Habitat

Definition

Nesting, over-wintering, and foraging habitat are critical to the survival of turtle populations. Significant turtle nesting habitat may be defined as an area that provides the appropriate conditions for laying eggs that is within a reasonable distance of an aquatic environment used by turtles. Also, the nesting site should have the potential for regular use, and there must be a pathway between the aquatic environment and nesting area that the adult and young turtle can negotiate. Significant turtle over-wintering habitat is an area that provides suitable conditions for over-wintering, where turtles are known, or have been known, to congregate. For wood turtles, significant turtle foraging habitat is a wide riparian buffer, often a few hundred feet, along an aquatic system.

Importance

Turtles are a long-lived group of animals that face many threats from human activities. There are seven species that occur in Vermont: spiny softshell, spotted turtle, and stinkpot are rare in the state; map and wood turtles are uncommon; and painted and snapping turtles are common. Some species, like the wood turtle, are especially threatened because collectors value them. Nearly all of the species spend most of their time in aquatic environments, except for nesting. The wood turtle is the exception to this rule; it needs not only an intact aquatic system, but also a wide riparian buffer for foraging (Fowle, 2001).

The greatest challenge facing turtles is their ability to produce young. This requires finding a place to lay eggs where they will hatch without being eaten or disturbed and where the young hatchlings can safely make it to an aquatic environment.

Turtles usually prefer a soft substrate such as sand or soil for nesting. An exception is the spiny softshell turtle that



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Spiny softshell turtle is a habitat specialist that only nests in a small number of sites in Lake Champlain.

often nests on shale beaches. Sites that provide the most suitable nesting area may show evidence of heavy use by the presence of spent turtle shells.

Although painted turtles prefer nesting near water, they have been known to travel up to one-half mile in search of an appropriate nesting area. Nesting areas for the various other turtles include sandy beaches, sandy riverbanks, sandy blowouts, sandpits, and soft soils. Some areas, like undisturbed sand beaches, may be used year after year with several individuals laying eggs. Humans and predators, especially raccoons, threaten the unhatched eggs.

Winter is another critical period for turtles. In Vermont, turtles will dig down into soft saturated substrate, such as a riverbank or a muddy lake bottom, to spend the winter. Turtles have the ability to draw oxygen from the water through their skin. Several turtles will often congregate together to overwinter. As an example, up to 100 spiny softshell turtles are known to congregate in a localized area of Missisquoi Bay. Disturbances to these wintering areas, such as placing fill in the water, dredging, and drawdowns, can kill the over-wintering adults.

Conservation Goals

A town or other planning group might adopt goals like these for the conservation of turtle nesting, over-wintering, and foraging habitat.

1. Ensure continued existence of important turtle nesting sites in the town or area of interest.
2. Conserve or provide long-term stewardship for connections between turtle winter or foraging habitat and nesting sites.
3. Protect or provide stewardship for areas of wide riparian buffers where wood turtles occur.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- **Vermont Fish and Wildlife Department:** The Department has specific information on sites where some of the rare and uncommon species occur during nesting, foraging, and/or over-wintering.

- ▶ **The Atlas of Reptiles and Amphibians of Vermont by Andrews:** This Atlas has town-level records of occurrence for all species. The information is incomplete because most towns have not had comprehensive surveys.
- ▶ **Knowledgeable individuals:** Local turtle experts, naturalists, resource managers, and other outdoors people know of areas where turtles nest.

Interpreting the Information

The level of detail of the information available from the Vermont Fish and Wildlife Department is variable. Location data may be as general as the name of the water body or river stretch in which a species was observed. Sometimes it is more specific, providing information on the number of individuals seen as well as the locations of nesting sites, over-wintering sites, or foraging areas. Information from people with local knowledge is valuable and should be confirmed with additional field work.

Conservation Strategies

Once information has been gathered on turtle nesting, over-wintering, and foraging habitat, you can develop specific conservation strategies to help achieve your goals. Some examples of strategies for each goal stated follow.

1. Goal: *Ensure continued existence of important turtle nesting sites in the town or areas of interest.*

Strategies:

- a. Identify important turtle nesting habitat in the town by consulting knowledgeable individuals and conducting field work with the landowner's permission.
- b. Educate landowners and resource managers about importance turtle nesting habitat in their area, especially those that are used by more than one individual turtle. Work with landowners and resource managers to manage known nesting sites to prevent human disturbance and predation.
- c. Add nesting sites an overlay district to restrict development of nesting sites and between nesting sites and foraging and over-winter habitats.



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2. Goal: *Conserve or provide for long term stewardship connections between turtle winter or foraging habitat and nesting sites.*

Strategies:

- a. Identify over-wintering sites and the corridors between important turtle nesting, over-wintering and foraging habitat by using aerial photographs and other maps and conducting field work.
- b. Provide for long-term stewardship or protection of these sites through landowner education, conservation easements, overlay districts, or other methods of conservation.

3. Goal: *Protect areas of wider riparian buffers where wood turtles occur.*

Strategies:

- a. Determine which streams harbor wood turtles by using the *Atlas of the Reptiles and Amphibians of Vermont*, by contacting the Vermont Fish and Wildlife Department, or by conducting field work.
- b. Provide for long-term stewardship or protection of these corridors through landowner education, conservation easements, or other methods of conservation described in the “Riparian and Aquatic Habitats” section of this manual.

Gathering New Field Data on Turtle Nesting, Over-wintering, and Foraging Habitat

Turtle nesting areas are often easiest to locate by finding the spent or predated eggshells. Further information is available from guidebooks and the Vermont Fish and Wildlife Department. To identify over-wintering areas, especially colonial areas, detailed study is necessary. This may include radio tagging individual turtles. This work would require a permit from the Vermont Fish and Wildlife Department.

Grassland Bird Habitat

Definition

Birds that rely on grassland habitat for their survival in Vermont include Henslow's Sparrow and Sedge Wren, both endangered species; Upland Sandpiper and Grasshopper Sparrow, both state-threatened species; Vesper Sparrow, an uncommon breeder in Vermont; and Savannah Sparrow, Bobolink, and Eastern Meadowlark, considered common but with declining populations. Other bird, mammal, and invertebrate species use grasslands as well, but the above suite is commonly used for conservation planning purposes because these birds are rare, their populations are declining, and they require grassland habitat to survive and reproduce. These species vary in their habitat requirements, but in general, they require open lands dominated by grasses, sedges, and broadleaf herbs with little or no woody vegetation.

Today, most of Vermont's grassland habitats occur in the Champlain Valley and, to a lesser extent, in the Connecticut River Valley and the area around Lake Memphremagog. There are other grasslands of various types and sizes scattered across the rest of the state. Most grasslands are associated with current or past agricultural practices. There are, however, grasslands that are the result of other human activities and are maintained for specific purposes. These include grasslands associated with airports (commercial and private), landfills, fairgrounds, and industrial complexes. Most of Vermont's grasslands are in private ownership, although the state and federal government own small areas of this habitat.

Importance

Since a probable historic high during the agricultural boom of the 1800s, populations of grassland birds have declined substantially in Vermont, primarily as a result of habitat loss. Habitat loss has resulted from forest succession after farm abandonment, changes in current agriculture

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Some birds that rely on grassland habitat in Vermont are rare and their populations are declining due to habitat loss. Bobolink (right), horned larks, and upland sandpipers (left) are good examples.

practices, and residential, commercial, and industrial development. Other potential threats include the extensive use of agricultural pesticides and changes in wintering habitats outside of Vermont.

Conversion of natural grasslands elsewhere in the Northeast and the Midwest led to the decline of grassland birds in their historic natural habitats and has prompted Vermont, and the Northeast in general, to take on a greater role in the conservation of grassland birds. The North American Bird Conservation Initiative (NABCI) has designated grassland birds as a priority species in Vermont.

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Conservation Goals

Actively managed landscapes play a critical role in the persistence of these species in light of the loss of natural grasslands. Maintaining managed grasslands, where possible and appropriate, in a manner compatible with grassland bird nesting is currently considered the most effective strategy for grassland bird conservation in the Northeast.

A town or planning group might adopt goals like these for conservation of grassland bird habitat.

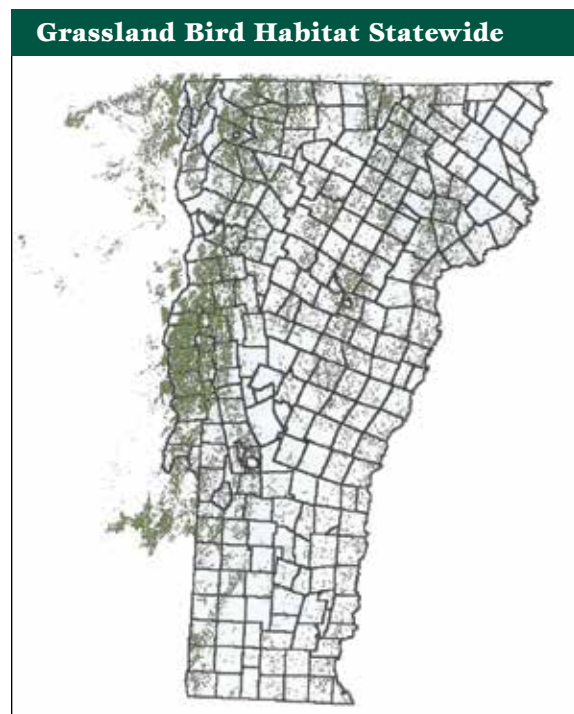
1. Where appropriate, encourage management of existing grasslands larger than five acres, including artificial habitats, in a manner compatible with successful grassland bird nesting.
2. Identify and maintain or increase populations of rare grassland birds in the town.

Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **The Vermont Center for Geographic Information:** The Center has digital orthophotos and land use/land cover GIS data that is helpful in identifying large grassland areas.
- ▶ **Audubon Vermont:** This organization coordinates surveys for grassland birds, provides outreach to landowners, and works with the Vermont Fish and Wildlife Department and others in habitat management and recovery planning.



Map 5-7 Potential grassland bird habitat based on Land Use-Land Cover data layer.



Map 5-8 This map shows open lands, natural and artificial, that may be suitable grassland bird habitat. (Source: Vermont Fish & Wildlife Department – Kevin Viani)

Interpreting Information

Information on the distribution and character of grassland habitat in Vermont is limited. Therefore, it will be necessary to focus on identifying this habitat through field inventories or aerial photography. The value of grassland habitat for grassland birds in Vermont will vary from region to region in the state. Grassland birds are most likely to occur in those parts of the state that have fairly flat topography, which typically is where most agriculture is located. The Champlain Valley, Connecticut River Valley, and parts of Orleans County tend to provide the best opportunities for managing this type of habitat for grassland birds. The size (number of acres) of the habitat is important, as described earlier. Focus on identifying those areas of grassland habitat greater than five acres.

Conservation Strategies

Once the information on grassland bird habitat has been gathered, specific conservation strategies can be developed that will help achieve the goals. Some examples of strategies related to each goal follow.

Note: *As with planning for the conservation of all natural heritage elements, implementing strategies for conserving grassland bird habitat should be done with consideration of other elements. It is not recommended that new artificial grasslands be created solely for the purpose of supporting grassland birds, nor is it recommended that strategies be implemented in areas with sensitive species or natural communities with conflicting needs. It is recommended that you contact the Vermont Fish and Wildlife Department and Audubon Vermont to discuss the importance of your town or area of interest to statewide grassland bird conservation efforts.*

1. Goal: *Where appropriate, encourage management of existing grasslands larger than five acres, including artificial habitats, in a manner compatible with successful grassland bird nesting.*

Strategies:

- a.** Establish compatible management practices on town-owned grasslands, such as the lawns of the town hall, school, recreation fields, and fairgrounds. Establish a demonstration site where appropriate management practices are employed and the virtues explained to the public by way of kiosks, signs, or other interpretive materials.
- b.** Provide incentives to private landowners for the compatible management of grasslands. USDA's Natural Resource Conservation Service administers the Wildlife Habitat Incentives Program (WHIP) that provides funds and technical assistance to private landowners for improving wildlife habitat. Similarly, the USFWS Partners for Fish and Wildlife Program provides financial and technical assistance to private landowners through voluntary cooperative agreements. Former agricultural land is increasingly being kept open for the preservation of view; this situation provides a great opportunity to manage habitat for grassland birds without any of the financial or technical constraints sometimes associated with agricultural operations.
- c.** In site plan review, require large expanses of grasslands proposed for industrial or commercial developments to follow sound grassland bird management guidelines.

Mowing Practices for Grassland Birds

The following management guidelines are designed to maximize reproductive success of grassland-nesting birds in an agricultural setting. We recognize that an active farm may be able to only partially implement these guidelines. However, the extent to which they are implemented will determine the benefit to the breeding bird population.

1. Delay mowing until July 15 each year to minimize loss of eggs and young. Later mowing may allow for the successful fledging of young from late nesters or re-nesting.
2. Raise mower blades to six inches or more to avoid crushing any remaining nests or young.
3. Avoid nighttime mowing to reduce the risk of injuring roosting birds.
4. When not used for high-quality hay, mow fields every 1-3 years. Conversion to cropland will destroy the nesting habitat of grassland birds.
5. Light to moderate grazing is compatible with most grassland bird species' needs. Consider restricting livestock from fields during nesting season and rotating pastures to provide a varied vegetation structure.

2. Goal: *Identify and maintain or increase populations of rare/uncommon grassland birds in the town or area of interest.*

Strategies:

- a.** Participate in or establish annual monitoring of grassland bird populations.
- b.** Include protection of rare species habitat in your town plan.
- c.** Use site plan review to evaluate if any rare grassland bird populations will be affected by proposed development.

Early-Successional Forest and Shrub Habitat

Definition

Young trees and shrubs, often occupying recently disturbed sites and areas such as abandoned farm fields, provide unique and important habitat for many wildlife. Some of the tree and shrub species that colonize abandoned agricultural land and disturbed sites include grey birch, dogwood, aspen species, cherry, willow, and alder. Due to the propensity of these plant species to quickly colonize disturbed sites, they are often referred to as “pioneer species.” These habitats occur throughout the state in various forms in wet conditions, dry conditions, and at mid-elevation and low elevation. These are not habitats typical of high elevation, at least not as defined by the species discussed here.

Importance

Many species of wildlife require early-successional forest and shrub habitat. Popular species such as ruffed grouse, American woodcock, and New England Cottontail require this habitat for many of their annual life needs. Songbirds such as the golden-winged warbler nest only in this sort of habitat and, in fact, are at risk of population declines due to the loss of such habitat.

New England in general, and Vermont specifically, has realized a drastic decline of early-successional forest and shrub habitat. This loss

is due largely to development and natural forest succession. Traditionally, this habitat was created by a variety of natural disturbances such as fire, floods, and wind, including hurricanes. In addition, human activities on the land, such as agriculture and timber production, created early-successional forest habitat. Today, with the chronic loss of agriculture, declining land ownership by forest products industries, and increased residential development of those same lands, opportunities for perpetuating these habitats is diminished. As a result, those species of plants, mammals, birds, amphibians, and reptiles that require this habitat to survive are generally declining in the Northeast region (Litviatus, 1999).



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In addition, these habitats support species such as ruffed grouse that have long been the passion of Vermont and New England upland game hunters. These habitats serve as sources for the production of such species as the American woodcock, whose populations continue to decline precipitously. Populations of American woodcock, a fascinating bird species unique to these habitats, are continuing to decline solely because of the loss of this habitat to development primarily, and forest succession secondarily.

Biophysical Regions

Percent Area of Each Vermont Bio-physical Region in the Seedling/Sapling Forest Size Class, 1997.



Map 5-7 Biophysical Regions with corresponding percent of this habitat condition. (Source: U.S. Forest Service)

Conservation Goals

It's important to consider several factors when deciding where and how to conserve and perpetuate early-successional forest and shrub habitat. Some areas of the state offer greater opportunities to benefit the species that require this sort of habitat than others. The Champlain Valley, for instance, is frequented more than the Northern Green Mountains region by the American woodcock and golden-winged warbler. That is not to say that this habitat is not found in the Northern Green Mountains; rather, it is to point out that a greater abundance of early-successional forest and shrub habitat in the lower elevation zones of Vermont provides greater value to the species that most require it. There are exceptions to this generalization. For example, Bicknell's thrush prefers the low density of spruce-fir forests of the higher elevations, which are often disturbed by winds and ice damage. Many widespread species, such as black bear and deer, benefit from the diversity of soft mast (berries) plants and browse that is made available from early successional habitat.

A planning group might adopt the following goals to conserve early-successional forest and shrub habitat.

1. Maintain early-successional forest and shrub habitat and, where appropriate, increase the acreage of this habitat within the town or area of interest. Be sure to consult with a wildlife habitat expert before deciding to promote the development of new early-successional forest habitat since some areas or sites may not be compatible or appropriate for the types of disturbance or management actions required to establish those habitats.
2. Encourage management of existing early-successional forest and shrub habitat in a manner compatible with the nesting, breeding, and brood-rearing requirements of species that are declining, such as American woodcock. This species may serve as a useful surrogate for the habitat requirements of other early-successional habitat dependant wildlife.



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Obtaining and Interpreting Information

Information Sources

See Appendix for information on how to contact or visit the websites of the agencies and organizations mentioned below.

- ▶ **Vermont Center for Geographic Information:** The Center has land use/land cover GIS data.
- ▶ **Agency of Natural Resources:** This agency maintains information on early-successional habitat occurrence on state land for most, but not all, state-owned parcels.
- ▶ **U.S. Forest Service:** This agency maintains data, maps, and information on the distribution of forest cover types, including early-successional forest, throughout the state and region.



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Conservation Strategies

Some strategies presented in other element sections may apply to the conservation and management of early-successional forest habitat. Once information on early-successional forest and shrub habitat has been collected, it is possible to develop specific conservation strategies to help achieve those goals related to this habitat. Some examples of strategies related to each goal follow.

1. Goal: Maintain early-successional forest and shrub habitat and, where appropriate, increase the acreage of this habitat within the town or area of interest.

Strategies:

a. Emphasize the importance of conserving, managing and perpetuating these habitats in a town plan or other planning document. **Sample Language:** *Early-successional forest and shrub habitat — important to the survival of many species of wildlife as well as related public interests — is declining statewide. The conservation, protection, management and, where appropriate, restoration of these habitats will be a priority.*

b. Identify areas of beaver activity or those with high potential for beaver activity, and ensure the continuation of beaver-related landscape dynamics. Protect beaver-influenced landscapes by requiring residents and road crews to pursue alternatives to dam removal.

c. Ensure that these sorts of habitats are represented in at least some of the land conservation or acquisition actions. Develop management and conservation plans for conserved lands, public or private, that support the protection, conservation, management and, where appropriate, creation of these habitats.

2. Goal: Encourage management of existing early-successional forest and shrub habitat in a manner compatible with the nesting, breeding, and brood-rearing requirements of the American woodcock. This species may serve as a useful surrogate for the habitat requirements of other early-successional habitat dependant wildlife.

Strategies:

a. Encourage agricultural and forest products economies by providing tax incentives or other incentives for large landowners to retain ownership and management of those lands.

b. Encourage large landowners to enroll in the current use program administered by the Vermont Department of Forests, Parks and Recreation. This program requires that a qualified professional develop a forest management plan. The program can be a useful tool for incorporating the actions required to perpetuate this sort of habitat and the species that rely upon it.



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PART III

Bringing Vision and Reality Together

CHAPTER 6



Conservation Planning in Ridgeville, Vermont



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Ridgeville is a typical, medium-size town in Vermont. Until the 1960s, the town had been a farming community of 1500 people. By the late 1960s, the town's population began to grow even as the farms around it began to disappear. In the 1980s, a children's clothing company chose Ridgeville for its headquarters, and a small, liberal arts college purchased a tract of land and established a satellite campus. The more urban, university town down the road mushroomed with high-tech companies and flocks of ex-urbanites fleeing from their hectic lives in Boston, New York, and other large cities.

Today, the town has a population of around 8,000 and is fast becoming a bedroom community for its much larger neighbor. Ridgeville has a number of environmental assets, among them some large tracts of forest, two good size streams with adjoining wetlands, and a large granite cliff that juts out from a high, grassland plateau. It also has an asset in its citizens who are active in community affairs and who value their fish, wildlife, and other natural resources for many reasons. Interest and participation in conserving the town's natural beauty and wildlife diversity started with a vision.

Step One: Setting Vision and Goals

The town's Conservation Commission developed a survey that was sent to all residents and available to regular visitors. The survey asked all interested parties questions such as the following: Why do you live or visit here? What is it you appreciate about this place? What do you want the town (or region) to look like in 20 years? In 50 years? In 100 years? What is preventing or inhibiting the town or region from realizing this vision?

The survey results not only revealed an in-depth picture of what people valued and wanted to see happen in terms of conservation in their town, but it generated a greater level of support for preserving the town's environmental assets since all interested parties had a voice in the process. The results were presented at town meeting.⁷

After the survey results were released, Ridgeville's Conservation Commission formed a working group of interested community members to draft a vision statement based on those attributes of the town's natural environment that were shown to be important to the community:

In 100 years, the fish, wildlife, and natural heritage of Ridgeville will be as healthy as it is today, even though the population is projected to grow by 25 percent in the next 15 years alone. Development will take place in well-defined, concentrated growth zones where natural resources are least fragile. Large patches of contiguous, unfragmented forest will continue to dominate the landscape, of which a portion will be working lands. Wetlands and streams will have natural vegetation surrounding them and will provide clean water and good quality fish and wildlife habitat. A diversity of landscapes and habitats will be conserved as public land and will be available to all for fish and wildlife-associated activities and outdoor recreation. All the native species and natural communities in the town will be healthy. The community's use of and connection to the land will be maintained and fostered through support of working lands and long-term land conservation initiatives and by educating private landowners about the value of undeveloped working lands to the economy, community, and the environment. We believe that the community must have access to the special places that compose our natural heritage and we will work to ensure that for generations to come.

Using the vision as a philosophical guide, the group began the process of setting well-defined conservation goals. They started by identifying the specific needs of the different natural heritage elements that were part of Ridgeville's environment. (See Chapters 3, 4, & 5 for a complete discussion of each element. The sidebar on pages 108-110 summarizes the goals for each of the elements.)

In developing a list of goals, the group explored some thinking about the development and demographic pressures on each element. They concentrated on those elements that were most at risk of being lost or negatively affected. They conducted a formal assessment, listing threats to each element and then ranking them in order of severity or immediacy. The assessment concluded the following: The town is a bedroom community for a large population center and, as such, is under tremendous development pressure. The group decided that to achieve their vision, they must start by preventing the fragmentation of large landscapes that are so often associated with suburbanization. This will mean protecting large contiguous forested areas, connecting lands, and buffers around wetlands and in riparian areas. They hope that by protecting these lands, the diversity of natural communities and physical features as well as many of the rare or vulnerable species found in the area will also be conserved.

Based on the needs they identified for each of the natural heritage elements and their threat assessment, the planning group adopted the following conservation goals, in order of priority:

1. Conserve or provide stewardship for at least two patches of contiguous forest habitat totaling a minimum of 1,000 acres within the town. This may take the form of cooperative agreements with private landowners, as well as more permanent conservation measures such as conservation easements or acquisition.
2. Avoid division of significant fish and wildlife habitat.
3. Ensure that fish and wildlife are able to move freely between habitats as necessary; for example, from mountain to lowland, wetland to upland, and hardwood forest to softwood forest.
4. Maintain and protect the functional integrity of all mast stands in the town or area of interest.

Continued on page 110

Sample Conservation Goals for Each of the Natural Heritage Elements

Conservation Goals for Contiguous Forest

1. Conserve and provide stewardship for relatively large patches of contiguous forest within the town or area of interest.
2. Conserve at least two patches of contiguous forest habitat totaling a minimum of 1000 acres within the town. (Note: The numbers are used as examples and are not intended to represent the needs and interests of all areas).
3. Ensure the maintenance and conservation of existing contiguous forest habitat and avoid subdivision and parcelization of that habitat.
4. Ensure the viability of working lands associated with a sustainable forest products economy due to their significant contribution to this and other natural heritage elements.

Conservation Goals for Connecting Habitat

1. Ensure that animals and plants are able to move freely between conserved lands, undeveloped private lands, contiguous forest habitat, and other important habitats, land features, and natural communities to meet all their requirements for survival. This may be accomplished by an increase in the number of acres of connecting lands/corridors under land stewardship and/or that are permanently protected or conserved.
2. Ensure that animals and plants can move long distances — beyond the boundaries of the town or area of interest — as they need to for breeding, dispersal, and adaptation to climate change, for example.

Conservation Goals for Enduring Features

1. Ensure that conserved lands or lands under long-term stewardship cover the full range of elevations in the town.
2. Ensure that conserved lands or lands under long-term stewardship cover all the town's bedrock types and surficial geology types, especially those types that are unusual in the state.
3. Ensure that conserved lands or lands under long-term stewardship encompass a diversity of landforms.
4. Seek to protect and conserve or place under long-term stewardship the “complementary landscapes” identified by the Vermont Biodiversity Project (see Vermont's Natural Heritage). Sometimes this will require cooperation with neighboring towns.

Conservation Goals for Natural Communities

1. Ensure the conservation and/or proper stewardship of significant natural communities found within the town.
2. Restore degraded but potentially significant natural communities to a viable condition in places where the land is suitable.
3. Ensure that within your biophysical region large-scale natural communities like Northern Hardwood Forests are conserved or are under long-term stewardship in parcels large enough (e.g., thousands of acres) to function ecologically with as great a breadth as possible. This may require multi-town efforts.

Sample Conservation Goals for Each of the Natural Heritage Elements

Conservation Goals for Wetlands

1. Protect or provide for the long-term stewardship of wetlands that support significant functions and values for natural communities, rare species habitat, and wildlife habitat, and prevent additional loss of wetlands within the town.
2. Restore and/or enhance the functions and values of wetlands already impacted by human disturbance.

Conservation Goals for Riparian Habitat

1. Provide for the long-term stewardship of and/or protect existing high-quality riparian habitat within the town.
2. Increase the number of miles of naturally-vegetated stream bank and lakeshore in Ridgeville. Natural vegetation should ultimately consist of native woody plant species, except where natural meadows occur, usually in association with wetlands.
3. Provide for the long-term stewardship of and/or the protection of existing high quality aquatic features and riparian habitats throughout the town.

Conservation Goals for Vernal Pools

1. Provide for the long-term stewardship and/or protection of vernal pools and associated amphibian populations.
2. Provide for the long-term stewardship of and/or protection or restoration of forested habitat between pools to provide dispersal corridors for dependent species, particularly amphibians.

Conservation Goals for Rare, Threatened, and Endangered Species

1. Increase populations of rare, threatened, and endangered species in Ridgeville.
2. Maintain, restore, provide stewardship for, and conserve habitats and natural communities that support rare, threatened, and endangered species.

Conservation Goals for Deer Wintering Areas

1. Maintain and protect the functional integrity of deer wintering areas within the town.
2. Increase the number of acres of deer winter habitat that are either under long-term stewardship or permanently conserved in town.

Conservation Goals for Mast Stands

1. Maintain and protect the functional integrity of all mast stands in town.
2. Increase the number of acres of mast stand habitat that are either under long-term stewardship or permanently conserved in Ridgeville.

Conservation Goals for Important Bat Habitats

1. Conserve or provide long-term stewardship to all bat hibernacula in Ridgeville.
2. Protect important bat maternity and foraging colonies in the town.
3. Work with other towns to protect regionally important hibernacula.

Sample Conservation Goals for Each of the Natural Heritage Elements

Conservation Goals for Important Turtle Habitats

1. Ensure the continued existence of important turtle nesting sites in town.
2. Conserve or provide for the long-term stewardship of the connections between turtle winter or foraging habitat and nesting sites.
3. Protect or provide stewardship for areas of wide riparian buffers where wood turtles occur.

Conservation Goals for Grassland Bird Habitat

1. Where appropriate, encourage management of existing grasslands larger than five acres, including artificial habitats, in a manner compatible with successful grassland bird nesting.
2. Identify and maintain or increase populations of rare grassland birds in town.

Conservation Goals for Early-Successional Forest and Shrub Habitat

1. Maintain early-successional forest and shrub habitat and, where appropriate, increase the acreage of this habitat within the town or area of interest. Be sure to consult with a wildlife habitat expert before deciding to promote the development of new early-successional forest habitat since some areas or sites may not be compatible or appropriate for the types of disturbance or management actions required to establish those habitats.
2. Encourage management of existing early-successional forest and shrub habitat in a manner compatible with the nesting, breeding, and brood-rearing requirements of species that are declining, such as the American woodcock. This species may serve as a useful surrogate for the habitat requirements of other early-successional habitat dependant wildlife.

Continued from page 107

5. Ensure that conserved lands in the town encompass a diversity of habitats and landforms.
6. Make sure that all the significant natural communities found within the town remain healthy and viable, providing habitat for all the species that inhabit them.
7. If there are significant natural communities that have been lost or degraded, seek opportunities to restore them to a natural condition in places where the land is suitable. This will likely require developing cooperative agreements with private landowners who are willing to engage in restoration efforts.
8. Make sure that within Ridgeville's biophysical region large-scale natural communities like Northern Hardwood Forests are conserved in large enough acreage to be fully functional. This may require multi-town efforts.
9. Prevent additional loss of wetland habitat within the town.
10. Protect the functions and values of existing wetlands.
11. Increase the number of miles of forested riparian streambank and lakeshore in the town.
12. Protect existing high-quality riparian habitat within the town.
13. Protect all important vernal pools and maintain associated amphibian populations.
14. Protect or restore forested habitat between pools to provide dispersal corridors for amphibians.
15. Maintain, restore, provide stewardship for, and conserve habitats and natural communities that support rare species.
16. Conserve all deer wintering areas within the town.
17. Protect important mast stands that have been delineated on the town wildlife habitat map from all direct and indirect disturbances.
18. Ensure continued existence and stewardship of important turtle nesting sites in the town.

Step Two: Gathering & Interpreting Information

The planning group gathered information from a number of sources, including several knowledgeable people within their community. From the Vermont Center for Geographic Information, the group obtained five digital maps showing which land had already been conserved, wetlands, the contiguous forest, landscape contours, and even tax parcels. Historical aerial photographs showed where the greatest degree of growth was taking place. The college supplied them with their management plan for the parcel of land they owned, and the two landowners with the largest forest parcels provided their land management plans that included timber production.



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The Vermont Fish and Wildlife Department was able to give the group an inventory of specific natural community types, as well as a list of the possible endangered and threatened species that may have habitat within the town's borders. They received an up-to-date report from Keeping Track® of the variety of wildlife in their area. Several people in the planning group were hunters and one was a nationally known wildlife photographer. These people were invaluable in helping to identify critical wildlife habitat.

The planning group examined all of this information and made several important observations.

First, the presently conserved parcels of land were not connected or adjacent to each other, but rather they were distributed across the town. Second, a rare species was found on only one of the conserved parcels. Third, most of the wetlands were located in the lower elevations of town, many being associated with streams and rivers. Finally, several of the large land holdings were within areas identified on the map as contiguous forest, as were some of the significant wildlife habitats.

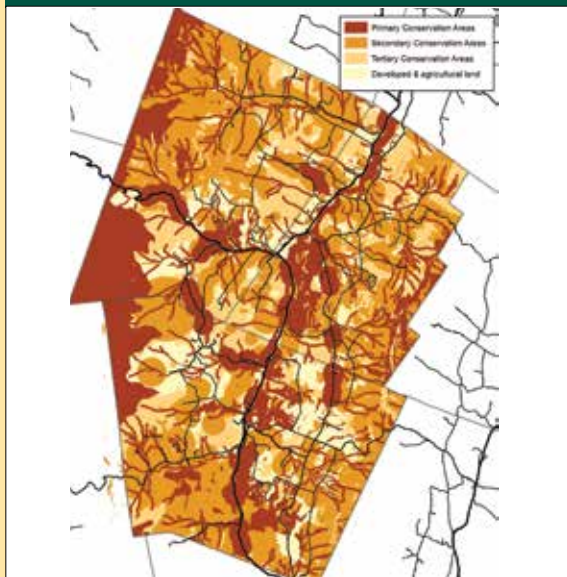
The group then identified those areas where there were multiple elements that overlapped. For instance, there were areas where wetlands, significant wildlife habitat, contiguous forest, and a natural community occurred together. Areas that appeared to support multiple elements were identified as potentially important for future conservation efforts. The group also decided that it was important to connect some of the conserved land and two of the largest areas of contiguous forest. From the information they had gathered, they identified several streams with forested riparian habitat that seemed to connect these areas. They also used the knowledge of local hunters and information from the Fish and Wildlife Department to identify two areas along a state highway where wildlife frequently cross. These road-crossing areas might be part of a corridor used by wildlife to move throughout the town. These observations and interpretations of the information were compiled into a report which used several maps to illustrate the group's conclusions.



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CASE STUDY: Prioritization of Multiple Heritage Elements in the Mad River Valley

Tiered Ecological Priorities



Tiered Ecological Priorities

Tiered Ecological Priorities shows areas that were identified as important for conservation based on information collected by consulting biologists working with the Vermont Fish and Wildlife Department as part of a Natural Elements Inventory for the Towns of Fayston, Waitsfield and Warren. The three levels, primary, secondary, and tertiary, reflect what are considered essential for maintaining fish and wildlife populations in the area as well as biological diversity. See the chart below for detailed information regarding the attributes for each priority level.

Primary areas are the most fragile and sensitive. They are limited in area, and allow little flexibility in their location and management. That is to say, they can't be moved and parts of them can't be developed and still maintain their current functions and values. Development should be avoided in these areas.

Secondary areas are ecologically significant, but are larger and offer more flexibility for how they are managed. Development should be avoided, where possible, in these areas and efforts made to keep development clustered around the edges, rather than penetrating into the middle of these sensitive communities.

Tertiary areas are ecologically important as habitat for far-ranging wildlife and for generally supporting or buffering the more ecologically sensitive areas. These areas allow for flexibility in how they are managed and certain sections of these

Primary Conservation Area

Rare, threatened & endangered species element occurrences

Wetlands & streams (with 50' buffers)

Bat hibernacula (with 300' buffer)

All lands over 2700' for Bicknells thrush

Riparian habitats as mapped by Arrowwood

Vernal pool (with 100' buffer)

FEMA 100 year floodplain

Fluvial erosion hazard zone

S1, S2, S3 natural communities and other locally significant (defined by Arrowwood)

Natural Communities that have a small or large patch size

Road crossings (delineated by Arrowwood) that occur on Rte 100, Rte 17, German Flats Road, East Warren Road, and Sugarbush Access Road

All lands with natural cover (using 2006 CCAP) within 1/4 mile of the above significant road crossings

Secondary Conservation Areas (Excludes Primary)

Vernal Pools (with 600' buffer)

Early Succession Habitats (Arrowwood)

Ledges (Arrowwood)

Grassland

Locally significant and natural communities defined by Arrowwood and NOT included in Primary Conservation Area (= S4 and S5 Natural Communities or those with Matrix patch size)

Road crossings (delineated by Arrowwood) that are NOT included in Primary Conservation Area (= road crossings on smaller roads with less vehicle traffic)

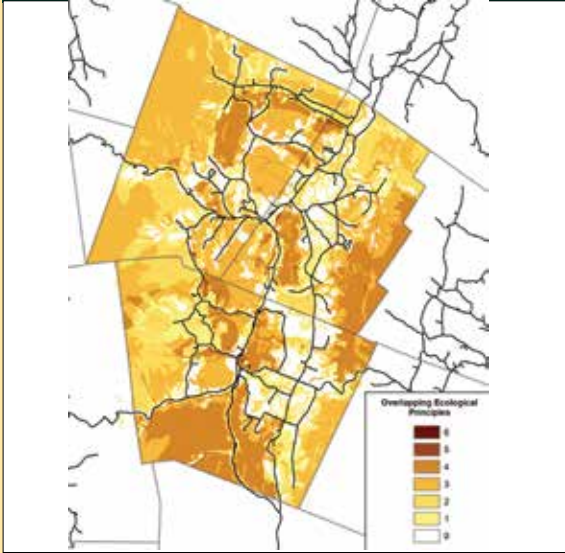
All lands with natural cover (using 2006 CCAP) within 1/4 mile of the above road crossings

Tertiary Conservation Areas (Excludes Primary & Secondary)

All lands included in a contiguous Habitat Unit (of any size) defined by Arrowwood

areas may be suitable for planned development without losing the current ecological functions that these areas offer. Still, efforts should be made to minimize impacts from development by clustering development around edges rather than developing in the middle of these areas.

Ecological Conservation Focus Areas



Ecological Conservation Focus Areas

Ecological Conservation Focus Areas identify the degree of co-occurrence, or overlapping, of several ecological principles. It shows areas appropriate for conservation action, such as where to focus technical assistance or where to focus voluntary land acquisition. It provides land managers and conservation organizations with a picture of where to get the most ecologically rich places in the least land area, which is to say where there are the most ecological principles at play in the landscape. This map does not prioritize conservation efforts nor does it incorporate necessary interconnections between ecological related areas. For example, for this analysis connecting lands and the large forest blocks they connect are treated

as separate elements, ignoring the fact that the connecting lands are useless without the forest blocks (and to some extent, vice versa). So, even if land managers decided to protect all lands that had a high level of co-occurrence among the ecological principles, the result on the landscape would not necessarily maintain the current populations of wildlife or biological diversity. The result would, however, secure areas of most biological diversity in the least land area; the most cost-efficient use of a conservation organization's resources. This map targets the first places for conservation action and technical assistance, but is not a plan for what areas are important for future sustainability or where town planning or zoning should focus. "Tiered Ecological Priorities" is more appropriate to inform planning and zoning efforts.

Ecological Principles

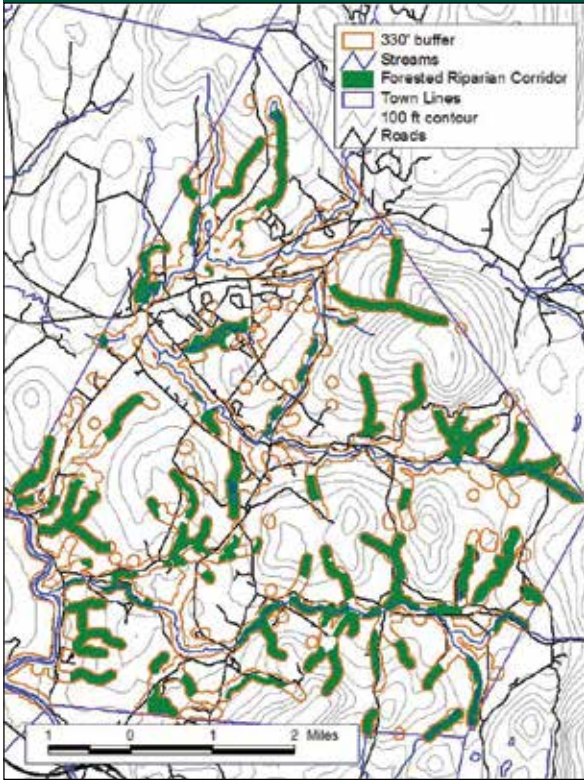
- Maintain large, intact patches of native vegetation
- Protect habitats that are key to the distribution and abundance of priority species
- Protect exemplary natural communities and aquatic features
- Maintain connections among wildlife habitats for species movement and gene flow
- Maintain significant ecological processes (such as wetland and floodplains recharging groundwater and filtering surface water)
- Contribute to regional persistence of rare species by protecting their habitat locally
- Ensure that the full range of native biological diversity is maintained by protecting ecosystems that are poorly represented in the landscape

Step Three: *Developing Conservation Strategies*

With their information gathered and easily accessible, the group studied the maps and other information. Over the course of several months, the group met and made notes about what had already been accomplished on town conserved lands and through regulations, and then began to make suggestions for conservation actions that might help in achieving the remaining goals. Figure 6-1 (following pages) is a table showing the initial notes and comments for five of their goals. They completed the table for all 18 of their goals and then discussed what actions they could take that might achieve more than one goal. They noticed that by having all the maps in one place and by looking at multiple fish, wildlife, and natural heritage elements simultaneously, they were able to find a number of cases where different elements overlapped.

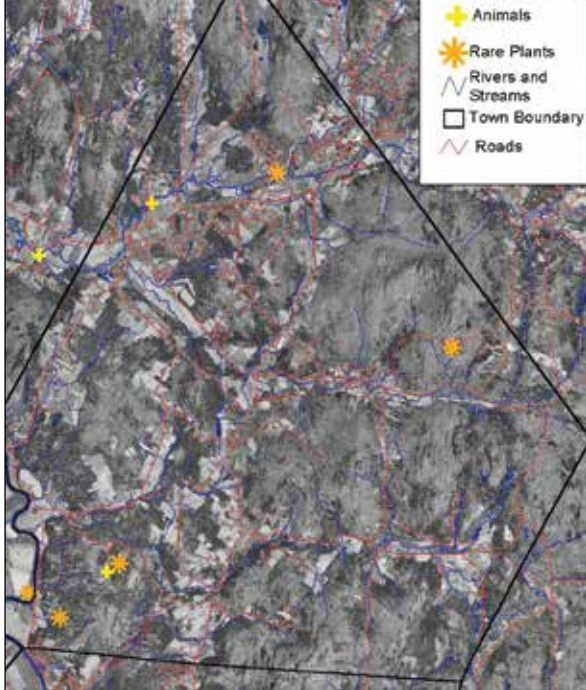
They learned that if a large parcel of conserved land in the southwest part of town could be connected with two large parcels of privately held land in the eastern part of town, many of their goals could be met. These three areas together contain a diversity of landforms (Goal 5), a significant natural community (Goal 6), a large area of Northern Hardwood Forest that extends uninterrupted into the next town (Goal 8), many wetlands (Goals 9 and 10), abundant riparian habitat (Goal 12), several vernal pools and the forested habitat between them (Goals 13 and 14), two rare plants and one rare animal (Goal 15), and part of a deer wintering area (Goal 16). In addition, these lands would support many of the community's fish and wildlife interests including hunting, fishing, trapping, and wildlife watching.

Riparian Buffer Forested/Nonforested in Ridgeville



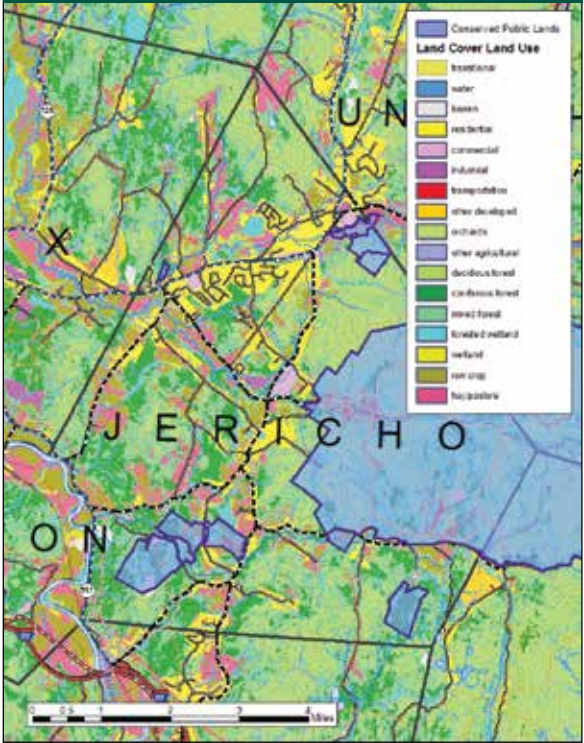
Map 6-1 Town Base; Contiguous Forest; Mast Stands; Vernal Pools; Riparian Buffer Forested/Nonforested.

Rare Plants & Animals in Ridgeville



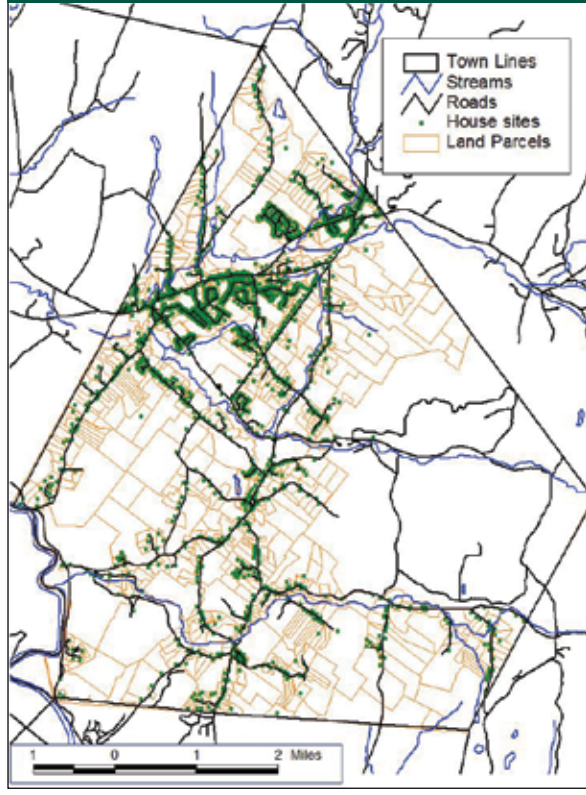
Map 6-2 Town Base; Wetlands; Rare, Threatened, and Endangered Species Points; Natural Communities; Deer Wintering Areas; Contours; Priority Aquatic Features.

Conserved Lands in Ridgeville



Map 6-3 The town of Ridgeville has large areas of conserved land and several parcels contain significant elements. (Source: Everett Marshall, Vermont Fish and Wildlife Department)

Tax Parcels in Ridgeville



Map 6-4 Town Base; Tax Parcels; and E911 Points. (Source: Vermont Fish & Wildlife Department – Kevin Viani)

Step Four: Implementing Conservation Strategies

With their vision, goals, and strategies clearly identified, the group then turned to implementation. In some cases, they were able to use just one strategy to accomplish several goals at once. They also found they could implement several strategies with one tool. For example, the east side of town had two large parcels of forest land which had been traditionally used by local hunters and others who enjoyed hiking, wildlife watching, and other outdoor activities – all of which were compatible with habitat conservation. The interests of the town residents in maintaining important wildlife habitat and outdoor recreation opportunities coincided with the interests of both the landowners who wanted to keep the land open

for public use and some timber harvesting. By using conservation easements, a 1000-acre patch of contiguous Northern Hardwood Forest could be conserved along with some high-quality riparian habitat and wetlands. The planning group began seeking conservation easement agreements with the landowners as a first on-the-ground task. At the same time, they began to consider implementing an overlay zoning district to maintain the connecting habitat between the conserved forest patch in the southwest part of town and the contiguous forest in the east part of town, and to revise their town plan to incorporate their new fish, wildlife, and natural heritage conservation goals and strategies.

Comments on Chosen Conservation Goals

| <i>Conservation Goal For Ridgeville</i> | <i>Has It Been Achieved? How and Where?</i> | <i>Proposed Conservation Strategies</i> | <i>Priority and Comments</i> |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>1. Conserve at least two patches of contiguous forest totaling a minimum of 1000 acres in the town.</i> | No. The acquisition or purchase of conservation easements of a large area of conserved land in the southwest part of town and two privately held parcels of land totaling more than 500 acres in size in the eastern part of town are begin explored. The landowners have not yet been contacted, but are said to be interested in keeping the land open for public use and some timber harvesting activity. | <p>1. Seek a conservation easement with the large landowners on the east side of town to conserve a 500-acre patch of contiguous forest there, along with the significant natural communities, rare species, wetlands, and riparian areas on that property.</p> <p>2. Seek a conservation easement with the managers of the conserved lands in the southwest corner of town and also with their abutters, so that a total of 1000 acres can be protected here.</p> | High. These actions would accomplish many goals at once. These two areas together contain a diversity of landforms (Goal 5), a significant natural community (Goal 6), a large area of Northern Hardwood Forest that extends uninterrupted into the next town (Goal 8), many wetlands (Goals 9 and 10), abundant riparian habitat (Goal 12), several vernal pools and the forested habitat between them (Goals 13 and 14), two rare plants and one rare animal (Goal 15), and part of a deer wintering area (Goal 16). |

Continued on next page

| <i>Conservation Goal For Ridgeville</i> | <i>Has It Been Achieved? How and Where?</i> | <i>Proposed Conservation Strategies</i> | <i>Priority and Comments</i> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>2. Ensure the maintenance and conservation of existing contiguous forest habitat and avoid subdivision and parcelization of that habitat.</i> | No. Division of forested tracts is one of the greatest threats to the natural heritage of Ridgeville's fish and wildlife. The tax map shows that the large, privately owned tracts are mostly in the upland forested areas, whereas the smaller parcels are in the lowlands, near roads. This, however, could easily change. | Promote a sustainable local and regional forest products economy through landowner education forums. Create zoning ordinances that promote cluster development and prevent subdivision in the interior of large forested areas. Require PRDs/PUDS in these areas. | High. Cluster zoning, if done carefully, will protect many heritage elements at once. A sustainable forest products economy will provide a financial incentive for good stewardship of the land. |
| <i>9. Prevent additional loss of wetland habitat within the town.</i> | No. Although the Vermont Wetland Rules protect all mapped (Class I and II) wetlands, they do not protect unmapped wetlands, of which there are many in town. | Conduct a new inventory of wetlands in town. Petition the Water Resources Board to reclassify these wetlands as Class II (significant) so that they are protected under the Vermont Wetland Rules. | High. Wetland loss will accelerate with development, so a new inventory to prevent it is crucial. |
| <i>11. Increase the number of miles of forested riparian streambank and lakeshore in the town.</i> | No. The number of miles of forested riparian streambank has been decreasing, not increasing, with development and road-widening. | Map standard riparian buffers of 330 feet through-out the town using GIS or paper maps. Using orthophotos, classify these into forested and non-forested riparian areas. In non-forested areas, work with landowners to revegetate buffers with trees, beginning with 50 or 100 feet. | High. Riparian buffers are vital for many functions, including serving as connecting lands (Goal 3). |
| <i>13. Protect all vernal pools and maintain associated amphibian populations</i> | No. We do not even know the location of all vernal pools. | <ol style="list-style-type: none"> 1. Use the information gathering techniques discussed in Part II, along with any new inventory work, to learn where all the vernal pools in town are. Inform landowners of the locations of vernal pools on their property, the habitat needs of the associated amphibians, and how they can preserve these pools and the amphibians using them. Develop a stewardship program to help landowners manage pools. 2. Include a vernal pool map in the Town Plan and emphasize the importance of conserving them. 3. Consider reclassifying pools as Class II wetlands so that they are protected by the Vermont Wetland Rules. | Medium. This will require a large expenditure of effort and resources. It is hoped that the coarse filter approach (protecting large landscape areas) will accomplish much of this. |

CHAPTER 7



Tools for Making Conservation a Reality



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Throughout this manual you have read in detail what natural resources may exist in a town or region and what role these resources play in Vermont's complex ecosystem. This chapter focuses on the legal and planning tools available to groups who are interested in protecting and conserving Vermont's vital natural resources.

Introduction

When discussing the authority of local Vermont officials, the first important issue is “home rule.” Simply stated, home rule means self-governance. Local officials need to be aware of the authority they have to enact laws to govern their communities, whether the goal is protecting natural resources or collecting taxes.

Interestingly, Vermont municipalities do not have home rule. Despite Vermont’s traditions of town meetings and strong local communities, Vermont municipalities have no *independent* authority to govern themselves. The authority for municipalities to govern comes from the legislature. With this authority, towns can levy taxes, enact various ordinances, and implement planning and zoning programs. If a state statute or local charter⁸ does not provide express or implied authority for municipalities to act, the authority does not exist. What this means in terms of conservation planning is that your municipality

may only adopt regulations or programs for which the legislature has given its the authority to do so under state law.

This chapter details the authority and the limits to that authority under state law and regulation that will affect conservation planning. Significant authority does exist under current state law for municipalities to plan as well as implement zoning and other ordinances to protect natural resources. These tools are summarized here, along with explanations of how they may be used to protect and conserve the fish, wildlife, and related natural resources that exist in Vermont communities.

The primary authority for municipalities to act to protect natural resources is located in Title 24, Chapter 117 – Vermont’s local planning and zoning enabling legislation. However, other tools also exist in Vermont law that relate to natural resource protection.

Planning

All land use regulation and conservation action begins with planning. Practically speaking, it is not possible to take action to protect or conserve natural resources on the local, state, or federal level without planning. It is impossible to protect natural resources without studying what resources exist in a community and determining how these resources fit in with a community’s vision for growth and change. This is especially the case given climate change and the diverse implications it brings. Legally speaking, planning is both a tool that communities may use to envision what their town will look like and a prerequisite for evoking state laws and regulations that will protect and conserve natural resources. Regional planning commissions can provide technical assistance in writing town plans and zoning ordinances. They also coordinate and write regional plans, many of which address regionally significant natural resources.

Regional planning commissions can provide technical assistance in writing town plans and zoning ordinances. They also coordinate and write regional plans, many of which address regionally significant natural resources.

Planning Authority

Under Vermont law, any “municipality may undertake a comprehensive planning program, including related preliminary planning and engineering studies, and prepare, maintain and implement a plan” (24 V.S.A. § 4381) The municipal planning commission is the entity in Vermont that is charged with carrying out these planning activities. Appointed by the municipal legislative body (city council, select board, or village trustees) or elected, the planning commission has significant authority at its disposal to evaluate the important resources of a community and plan for a future that protects these resources (24 V.S.A. § 4323). The broad powers of the planning commission are set forth in 24 V.S.A. § 4325. A planning commission may undertake capacity studies and make recommendations on matters of land development, urban renewal, transportation, economic and social development, urban beautification and design improvements, historic and scenic preservation, the conservation of energy and the development of renewable energy resources, and wetland protection.

Although wetland protection is singled out as an area for study under this section of the law, the planning commission has authority to study and make recommendations to protect all natural resources under the umbrella of making “recommendations on matters of land development.” (24 V.S.A. § 4325 (4)).

To enable the planning commission to implement these broad powers, Vermont law authorizes the planning commission to gather information to support its efforts. For example, the planning commission may require the recreation department to gather statistics on how people use a large piece of open land. The commission may go on land to make examinations and surveys.⁹ The commission may also retain staff and consultants to help guide its planning initiatives (24 V.S.A. § 4325(8), (9) and (11)).¹⁰ Similarly, if a municipality has a conservation commission this organization can inventory the municipality’s natural resources as well as lands with historic, educational, cultural, scientific, architectural, or archaeological values in which the public has an interest (24 V.S.A. 4505).

The planning commission may obtain funding by working with the select board and the town voters to obtain budget approval at town meeting for its program and administrative spending. Alternatively, it may seek grant funding from a variety of sources, including the Housing Conservation Trust Fund or the Department of Economic, Housing, and Community Development, Municipal Planning Grants. Some assistance is available from regional planning commissions.

Each municipality approaches the budget process differently. The process will also be affected by whether you have a town manager or administrator in your municipality. However, as a general rule, planning commissions should approach their legislative bodies about funding for planning initiatives they wish to undertake and ask that the funding request be placed on the agenda for town meeting. If the legislative body declines to place a budget item requested by the planning commission, zoning board of adjustment, or development review board on the town meeting agenda, 5 % of the registered voters in a municipality may petition to have the item placed on the town meeting agenda for a vote (17 V.S.A. § 2642, 2643). It is always a good idea to have the conversation about funding with the select board before taking the sometimes confrontational step of petitioning for funds. If funding is obtained, a municipality will have significant authority through the planning commission to study the natural resources that exist in the community and make recommendations. Being aware of the natural resources in a municipality is itself a tool that can be used to protect natural resources.

The Town Plan as a Tool

Municipalities are authorized under Vermont law to take the information gathered in the studies they undertake and develop a comprehensive municipal plan (town plan) (24 V.S.A. § 4381). Vermont state law lists numerous elements that must be included in a town plan (24 V.S.A. § 4382(a)). Specifically, town plans *must* include:

- ▶ a statement of objectives to guide future growth and to protect the environment;
- ▶ a land use plan, with a map that indicates areas proposed for forests, recreation, agriculture and residential, commercial, or industrial development;
- ▶ a transportation plan that includes scenic routes, recreation paths in addition to parking, main roads, and mass transit;
- ▶ a utility and facility plan; and
- ▶ a statement of policies on the preservation of rare and irreplaceable natural areas, scenic and historic features, and resources (24 V.S.A. § 4382(a) (1), (2), (3), (4) and (5)).

These are just five of the 11 elements that must be included in a town plan. Clearly the provision related to policies on preserving rare and irreplaceable natural areas speaks directly to the issue of natural resource protection and conservation. However, the other less specific provisions cited above relate to natural resource protection and conservation as well, providing opportunities for the thoughtful integration of natural resource planning with other municipal goals.” For example, in adopting objectives to guide future growth, a municipality may state that protection of wetlands, significant wildlife habitat, and water quality is a priority that should be reflected in how development occurs in the community. Similarly, a land use map could reflect forest or agricultural areas that contain natural resources that the municipality intends to protect, while residential, commercial, and industrial areas could be located where the town planners have determined there will be the least detrimental effect on the natural resources and associated public interests.

Studies have demonstrated that growth will occur where a community chooses to construct and maintain roads, facilities, and utilities. Accordingly, town officials may decide to not plan such infrastructure for areas in the town that are rich in the natural resources the community wishes to protect. Likewise, a town may decide to direct its financial resources toward providing amenities (such

as wastewater treatment facilities and upgraded roads with sidewalks) in those areas where the plan envisions development taking place. Planning groups may want to investigate community revitalization programs, including downtown and village center, growth center, and new town center designations. These programs are under the Vermont Agency of Commerce and Community Development and support such areas as traditional downtowns, emerging downtowns, and village centers.

Developing a comprehensive municipal plan is an important first step that a municipality can take to protect and conserve fish and wildlife resources and associated public interests. The planning process may include the following:

- ▶ undertaking studies to gather data about important natural resources;
- ▶ convening groups of citizens to assess and incorporate their visions for future land use, as well as inform them of the importance of their town's natural resources;
- ▶ staying involved with watershed planning efforts that take place on a more regional level than municipal planning;
- ▶ meeting with state agencies such as the Vermont Agency of Transportation and Vermont Agency of Commerce and Community Development, or Department of Public Service (regarding the development of renewable energy facilities) to evaluate their plans for infrastructure development; and
- ▶ addressing needs of projected populations in ways that ensure conservation of important natural assets.

Regulatory Effect of a Municipal Plan

The plan is the vision for growth expressed by the town and is the underpinning for any local regulation that a municipality decides to implement (see subsection (d) below). Under Vermont law, a town plan does have a role in some regulatory processes that may be used to protect natural resources.

A 2008 Vermont Supreme Court decision often referred to as “In re J.A.M. Golf” struck down a portion of South Burlington’s zoning ordinance for being overly vague on what natural resources the town wanted to protect and what level of protection the town wanted those resources to receive. The court also spoke to inconsistencies in the town plan and suggested that to be enforced as a regulation, a plan provision must contain a specific policy and standards

to be enforced. General language supporting rural character was considered insufficient. This suggests a need for specificity in the plan as well as clear definitions in the plan and in zoning bylaws for all natural resource that are being protected.

Act 250

The best known process in which the town plan has regulatory effect is Act 250, Vermont’s state land use and development law. Act 250 is a complex statute that entire books have been written about.¹¹ For the purposes of this manual, it is sufficient to say that Act 250 is a statewide land use review process for large development projects. In municipalities that have both zoning and subdivision rules in place, Act 250 regulates developments on more than 10 acres of land or construction of housing projects with 10 or more units, constructed or maintained on a tract or tracts of land owned or controlled by a person within a radius of five miles and within a continuous period of five years. In municipalities without both zoning and subdivision in place, Act 250 regulates development on more than one acre of land (10 V.S.A. § 6001).

Act 250 includes 10 main criteria and numerous sub-criteria that a developer must meet to obtain a permit from a regional District Commission. Criterion 10 of Act 250 states that to obtain a permit, an applicant must demonstrate that a project meets the following:

Is in conformance with any duly adopted local or regional plan or capital program under Chapter 117 of Title 24. In making this finding, if the board or district commission finds applicable provisions of the town plan to be ambiguous, the board or district commission, for interpretive purposes, shall consider bylaws, but only to the extent that they implement and are consistent with those plan provisions, and need not consider any other evidence (10 V.S.A. § 6086(a)(10)).

This powerful provision means that if language in a town plan specifically indicates that certain fish, wildlife, and natural resources are important and should be protected or otherwise conserved, projects that fall under Act 250 will likely be found to violate criterion 10. In this sense, a town plan can have a regulatory effect in the Act 250 process.

Both the municipality (the legislative body) and the local planning commission are “statutory parties” to each and every Act 250 application filed in a town. This means both the select board or city council and the planning commission have the right to request an Act 250 hearing if one has not been scheduled, present evidence at Act 250 hearings, and cross-examine or question other parties participating in the Act 250 process. It is as a legal party to the proceeding that the municipality must make its case to the District

Commission in terms of whether a project conforms to a town plan or not.

Both the legislative body and the planning commission may participate in the Act 250 process independently, but it is strongly recommended that the municipality develop a single position on whether or not a project conforms to the town plan and present that position to the District Commission through one representative. Failure to do so will create confusion for the District Commission, may create divisions within a municipality, and may give the District Commission the opportunity to ignore the municipal positions.

It is also extremely important to note that a town plan will not be considered in the Act 250 process if it is not in effect and duly adopted. This means that the plan must be approved by both the municipal planning commission and the local legislative body, and that the plan has not expired (plans expire every five years) (24 V.S.A. §§ 4385 and 4387).¹²

Finally, municipalities (through the select board and/or the planning commission as statutory parties) may address all of the Act 250 criteria and sub-criteria, not just criterion 10. Many of the Act 250 criteria relate directly to natural resources. For example, Act 250 criteria address the effects of a project on lakes, ponds, streams, headwaters, wetlands, shorelines, wildlife habitat, rare and irreplaceable natural areas, and endangered species (10 V.S.A. § 6086(a)). The municipality may present evidence with regard to the impact of a project on any of these resources. Several municipalities around the state have incorporated all the Act 250 criteria in their local bylaws.

Vermont Wetland Rules

Under the Vermont Wetland Rules (VWRs), citizens may petition the Agency of Natural Resources, the state body responsible for promulgating and administering the VWRs, to reclassify wetlands. Under current state law, all wetlands mapped on the National Wetland Inventory maps (the wetlands that are identified on most available maps for planning purposes) are considered Class II wetlands unless otherwise classified. This means that they are protected by the standards set forth in the VWRs. There are very few wetlands in Vermont that are classified as Class I wetlands, the highest classification representing the state's most significant wetlands.

Communities, conservation commissions, and related organizations can choose to evaluate the wetlands in an area and decide whether some of them warrant reclassification to properly recognize their values to the community and ecosystems and to

afford them further protection. This process has been streamlined and the necessary forms are available from Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division. Evaluating wetlands for reclassification is a great way to learn more about the wetlands in a community. Assistance for reclassification may be available from the Agency's Watershed Management Division.

Access Permits

Under Vermont law, a permit is required to do any work within the town or state highway right-of-way (19 V.S.A. § 1111). The most common request for a permit under this law is for approval to create access from the public right-of-way onto private property.

The municipal legislative body is responsible for reviewing these access or curb cut requests for town highways. The Vermont Agency of Transportation (VTRANS) is responsible for issuing access permits on state highways. The access permit review process has traditionally involved ensuring that turns made from the public highway to private property are safe. For example, permits may not be granted if the town or state finds that there is inadequate sight distance to allow vehicles to make safe turns in and out of the private property onto the town highway.

In addition to safety issues, 19 V.S.A. § 1111 also recognizes that creating access from public highways may lead to development and that any such development should be consistent with planning efforts. This statute provides that the state or town may not deny reasonable access from a public highway "except as necessary to be consistent with the planning goals of 24 V.S.A. § 4302 and to be compatible with any regional plan, state agency plan or approved municipal plan."¹³

A close reading of 19 V.S.A. § 1111(b) indicates if a town plan identifies a parcel of property as part of a significant natural resource area, the municipal legislative body or VTRANS may deny or restrict access if it is established that granting access will lead to development that is inconsistent with the plan. As with the use of a town plan in Act 250, a municipality's ability to alter proposed development based on the effect access will have on natural resources will depend upon the specificity and strength of the language in the town plan. In light of this provision, municipalities should carefully consider how it characterizes the importance of natural resources in its town plan and work with the municipal legislative body and property owners to ensure that it is understood that provisions of the town plan may affect the ability of landowners to gain access to property from town and state highways.

Town Plan as the Basis for Regulation

The main purpose of the town plan is to provide the vision for the future of the community and enable the community to take the next step beyond planning — implementation through zoning and/or subdivision regulations. Zoning and subdivision bylaws are probably the most direct and effective tools that municipalities have to regulate development to protect natural resources.¹⁴

The authority to adopt zoning and/or subdivision bylaws is found in 24 V.S.A. § 4401.¹⁵ This provision states that “any municipality which has adopted and has in effect a plan and has created a planning commission under this chapter, may implement the plan by adopting, amending, and enforcing any or all

of the regulatory and non-regulatory tools provided for in this chapter.” This means that according to Vermont law, a municipality may only enact or amend bylaws to protect natural resources (or do anything else) if it has adopted a town plan and created a planning commission. Moreover, any bylaws adopted must implement the plan. Thus, the natural resources important to your community must be discussed and identified in the town plan to legally justify enacting local laws to protect these resources.

In effect, the town plan lays the foundation for the regulation of development in your community. The sections that follow discuss specific bylaws that municipalities are authorized to adopt that can be used to address the impact of development on natural resources.

Zoning and Subdivision Bylaws

There is no shortage of supportive language in state law to demonstrate that the legislature intended to authorize municipalities to be able to take action to protect natural resources if a local community chooses to do so. Prior to discussing the details of specific regulatory tools, consider that 24 V.S.A. § 4401 states that all bylaws adopted under Chapter 117 must be consistent with a plethora of goals established in law that include identifying, protecting, and preserving:

- ▶ significant natural and fragile areas;
- ▶ outstanding water resources (lakes, rivers, aquifers, shorelands, and wetlands);
- ▶ significant scenic roads, waterways, and views; and
- ▶ the quality of air, water, wildlife, and land resources.

These are just a few of the goals related to the protection of natural resources that are articulated in 24 V.S.A. § 4302 – the purposes section of Title 24, Chapter 117. Municipal officials are encouraged to review the entire section to obtain the big picture view of what planning and zoning may be able to accomplish in Vermont with regard to protecting natural resources.

Your regional planning commission can assist in writing zoning ordinances.

Zoning Bylaws Generally

Statute 24 V.S.A. § 4402 provides that a “municipality may adopt regulatory tools including zoning, site plan review, subdivision and phasing. 24 V.S.A. § 4403 enables a municipality to use additional tools not specifically listed, in conformance with the municipal plan and statutory purposes.

Zoning Districts

State laws 24 V.S.A. § § 4411 (b) authorizes municipalities to create a zoning map that divides the town into zoning districts within the municipality. Dividing the municipality into zoning districts allows local zoning authorities to regulate uses of land differently. Districting is both a simple and a powerful tool that a municipality can use to protect natural resources. For example, local planners can ensure that a town forest is part of a forest, recreation, and/or conservation district where only low intensity uses (such as recreation, forestry, camps, etc.) are allowed.¹⁶ (See 24 V.S.A. § 4414.) Conversely, areas of the town that are limited in water resources, critical wildlife habitat, and other resources can be identified as districts where residential and/or commercial development is appropriate. In addition, village districts can recognize the traditional growth center of a community, and zoning bylaws may be structured to encourage development to in-fill and expand these

existing developed areas while preserving natural resources in outlying parts of town.

Similarly, municipalities can set different lot size and dimensional requirements in districts to minimize the effect of development on natural resources. For example, 24 V.S.A. § 4414 (1) (B) authorizes municipalities to create large lots in agriculture districts. Requiring large lots in agricultural and forest districts is a way to ensure that a dense population will not encroach on natural resources in the area. While large lots can reduce overall density, policies regarding large lots should be careful to avoid unintended consequences like excessive fragmentation, leap-frog development, increased land consumption, and increased cost of providing infrastructure (roads) and services (fire and police protection, school transportation). Moreover, dimensional and density requirements (closer set backs, smaller lot sizes, clustering development, etc.) can be allowed in existing growth centers to encourage development in areas that are not near intact forests and undeveloped open spaces. Planning for compact development is a powerful tool for natural resource protection.

Two effective zoning tools are the creation of ridgeline districts and riparian protection zones. Although often enacted to address aesthetic concerns, precluding or limiting development above a certain elevation will have the effect of protecting habitat that exists at these elevations and water quality that is adversely affected by erosion often associated with ridgeline development.¹⁷ Keep in mind that much conserved land in Vermont is ridgeline or upper elevation land. Lands at lower elevations such as river valleys have far less conserved land, but greater conservation value in terms of diversity of plant and animal species and a greater diversity of landscapes and natural communities. In addition, these are the areas at greatest risk of being lost to development.

Overlay Districts

Municipalities may also create overlay districts that do just that — “overlap” all zoning districts. Municipalities commonly take this approach to protect water resources, for example, with flood hazard overlay zones. Several Vermont municipalities require development to occur outside of a stated buffer area from lakes, ponds, streams, and rivers. This buffer becomes a district that overlays all the other requirements for the municipality’s various zoning districts. Similarly, district overlaps may be created through the prohibitions on development on steep slopes over a certain grade. Such prohibitions ensure

that erosion will not occur as a result of development on hillsides or on steep grades.

Municipalities may also use buffer requirements to protect a variety of natural resources. Municipalities may, for example, require a set back between development and all wetlands, significant wildlife habitat, habitat for rare, threatened or endangered species, and unique natural communities. Such bylaws would create overlay districts that must be observed to avoid affecting these resources. Overlay districts are commonly used to require additional review for what, in some cases, would otherwise constitute permitted uses.

Creating overlay districts to protect natural resources may require hiring a planning consultant. Each year the Vermont Agency of Commerce and Community Development (ACCD) issues planning grants to numerous municipalities. The grants may be used to hire consultants to work with towns to update town plans and craft bylaws, including bylaws designed to protect natural resources. The Vermont Fish and Wildlife Department is also available to assist towns in developing appropriate regulations for establishing buffers to protect important natural resources and to interpret information in deciding whether a proposed development complies with such regulations.

Zoning Bylaws to Protect Natural Resources

In addition to creating zoning districts, municipalities have the authority under state law to utilize other tools in their zoning bylaws (24 V.S.A. § 4414). Below is a list of types of regulations that municipalities may use to protect natural resources.

Conditional Use Review

The review (24 V.S.A. § 4414 (3)) involves an evaluation of whether a use in a district may be permitted by the municipal zoning board of adjustment or development review board.¹⁸ For example, commercial development may be a conditional use in a rural residential district. This means that commercial development is not prohibited in this district. Rather, the development may proceed if it meets specific conditional use criteria established by the town. Municipalities may adopt criteria to add to the statutory criteria set forth in 24 V.S.A. § 4414 (3) (B) specifically to ensure that natural resources are protected. An example of such criteria “is the project will not have an undue adverse impact on streams, lakes, ponds, wetlands, significant wildlife habitat, rare, threatened, and endangered species” (or any of the elements presented in Part II of this book).

Site Plan Review

Municipalities frequently use a site plan review (24 V.S.A. § § 4402 (2) and 4416). The purpose of site plan review is to minimize the effect of larger residential and commercial developments on the site.²⁰

Parking and traffic circulation on-site is a common issue that arises during site plan review. Under Vermont law, however, municipalities are authorized to consider other on-site impacts, including those that would affect natural resources. Accordingly, municipalities may use criteria similar to the ones referred to under the section on conditional use review. These criteria address on-site effects on natural resources, such as distance from adjacent or nearby uses, and set performance standards that define acceptable levels of noise, vibration, smoke, dust, lighting and night sky visibility, or planting plans. One such bylaw requires that a landscape be preserved in its natural state insofar as is feasible by minimizing tree and soil removal and nonessential grading, as well as planting of hardy shade trees along a public way (Jericho Zoning Bylaws). The Manchester site plan review requires the applicant to show "...open space, open space linkages..." This same bylaw also designates a forestry and recreation district to delineate "areas where substantial development of the land in terms of buildings, structures, or other intensive uses are prohibited because of topography, shallow soils, because the use involves inefficient development of community facilities and infrastructure or protection of vital watersheds."

When should a municipality use conditional use review, site plan review, or both to address the effects of development on natural resources? As with most choices regarding local planning and zoning, the answer depends on the municipality, the town plan, and the situation at hand.

Generally speaking, however, it is fair to say that conditional use review is utilized when a municipality is concerned about whether a proposed use (residential, commercial, etc.) is appropriate in an area of town and whether that use will have an external effect, say on the character of a neighborhood. Site plan review typically comes into play when the use is not in question, but when municipalities still want to guard against adverse effects on the site. Deciding which tool to use goes beyond the issue of potential effects on natural resources and will depend on the patterns of development in each individual town. For instance, many municipalities review cell tower

applications as conditional uses, uses that would be allowed in most if not all districts as long as they meet standards pertaining to issues such as setbacks, screening, height, parking, and density.

Transfer of Development Rights

Transfer of development rights (TDR) is a zoning tool that was created specifically to enable municipalities to protect natural resources and open space (24 V.S.A. § 4423). The TDR concept, in principle, is simple. The details of developing and implementing a TDR program, on the other hand, can be complicated but worth the effort.

TDR programs allow a municipality to identify areas that it wishes to preserve for conservation and areas where it would like to encourage development. Once an area is identified, the municipality can begin to accept applications for zoning permits to purchase development rights in the conservation areas. Development rights must be purchased through a conservation easement or deed. A development rights agreement can include density bonuses as an incentive to conserve a natural resource. Density bonuses allow higher density development in areas that are not deemed environmentally sensitive, in return for conserving those areas that are sensitive. In this fashion, fairness is established among the private landowners in a community so that all landowners may realize a reasonable economic return on their investments in property ownership. At the same time, the community's interests in land and natural resource conservation may be realized in a logical, thoughtful way by encouraging growth in sensible areas and encouraging conservation in areas where it makes the most sense.

TDRs are a powerful conservation tool. They allow conservation to occur by encouraging developers to conserve land, and they allow municipalities to direct development to the areas it wants to see grow. TDRs are not used by many Vermont municipalities, although more towns are including them in their bylaws. Though a useful conservation tool, its application in Vermont has been very limited for a variety of reasons, including the lack of market demand for density that exceeds the allowable zoning densities, the lack of receiving areas that have the capacity for significant increases of development density, and the administrative requirements for such a program. Planned Unit Developments (PUD)

Planned unit development (PUD) bylaws are designed to facilitate thoughtfully planned developments that maximize the use of land while preserving open space (24 V.S.A. § 4417). PUDs generally include a mix of residential and commercial uses in a single development.

Like TDRs, PUD bylaws allow applicants to use more available space for building by providing density bonuses and even authorizing the town to waive set back and other dimensional zoning requirements. The idea is to create a more clustered development that preserves a large portion of the lot as open space. Typically PUD bylaws require 50% of the lot to be preserved as open space, recreation, and/or conservation areas in exchange for the ability to deviate from set back and density requirements. As with TDRs, the open space/recreation/conservation portion of the development is usually preserved through a conservation easement or deed restriction. Accordingly, PUD bylaws are another potential way of getting developers to become partners in conservation by proposing smart, well-planned developments that ensure that certain lands will be protected. The key to making conservation a successful part of this process is to identify the areas of land with the greatest conservation value, rather than the land that has the least development potential or that is most convenient for subdivision design. Too often PUDs provide open space that has little or no conservation value.

Under Vermont law, PUD projects may only proceed simultaneously with the formal subdivision of land. To implement a PUD program, a municipality must adopt separate subdivision bylaws. Local officials may contact VLCT for sample PUD language or for a list of consultants.



Subdivision Bylaws

As previously noted, zoning and subdivision bylaws are completely separate. Many municipalities have zoning but not formal subdivision bylaws.²¹ In these towns, proposals to divide land require a simple zoning permit, but the project is not subject to a comprehensive subdivision review.

The requirements for comprehensive subdivision review are set forth in 24 V.S.A. § 4418. This law enables municipalities to determine the size of a subdivision that will trigger a formal review (2, 3, 4, 5 lots, etc.). State law also requires that, at a minimum, the subdivision review include standards for the design of internal streets, lighting, utilities, water, and sewer. The purpose of the review is to allow towns to consider the effects of a project at the stage that land is being divided. As such, subdivision review is an excellent tool for addressing how natural resources will be affected.²²

Municipalities may include in their subdivision regulations criteria related to natural resources. For example, the subdivision may be required to respect buffers around streams and critical wildlife habitat prior to obtaining subdivision approval. Such criteria ensure that any development that proceeds on the subdivided parcels will avoid harming these natural resources. Accordingly, local officials are strongly encouraged to explore the use of subdivision bylaws as a tool to protect natural resources.

Non-Regulatory Tools

In addition to zoning and planning, state law provides several other mechanisms that municipalities may use to protect natural resources. Four of the most effective tools are the authority to establish a conservation commission, the authority to conserve land, the authority to manage the town highway system, and the authority to adopt impact fees.

Conservation Commissions

State law (24 V.S.A. § 4505 Chapter 118) authorizes municipalities to establish conservation commissions. Most often created by the voters, conservation commissions have the power to act in many ways that can protect natural resources. For example, conservation commissions may:

- ▶ inventory and study the natural resources of the municipality;
- ▶ inventory land that has scientific and educational value;
- ▶ recommend that the town purchase or accept land;
- ▶ receive grants and gifts to be kept in a conservation fund;
- ▶ administer conservation lands;
- ▶ provide advisory environmental evaluations to Act 250 and local planning and zoning boards on the impact of pending applications on natural resources; and
- ▶ participate as a party in zoning appeals in environmental court.

This statutory authority gives local conservation commissions a vital role in protecting a community's natural resources. The Association of Vermont Conservation Commissions (AVCC) is an excellent resource for communities that have or that are considering conservation commissions. (See the Appendix for contact information.) AVCC has a "List Serve" that provides valuable information to conservation commissions and to people interested in starting a conservation commission.

Acquiring Land and Conservation Easements

As noted above, one of the key powers of a conservation commission is the ability to recommend that the municipality acquire land and maintain a conservation fund to support land purchases. Vermont law specifically authorizes select boards to purchase land for conservation purposes. Accordingly, obtaining voter approval for the select board to spend town funds for land conservation and all the associated public interests is an excellent tool.

To avoid the need to seek voter approval for land acquisition at each town meeting, municipalities may establish reserve funds for conservation purposes that roll over from year to year (24 V.S.A. § 2804, general statute authorizing reserve funds). Reserve funds and conservation funds administered by the conservation commission can become reliable resources that enable local communities to act expeditiously to purchase land or development rights to conserve natural resources. A useful tool for making effective use of such funds is to develop a priority land conservation plan. Based on the process outlined throughout this manual, this plan would identify those lands within the community that are the most important for acquisition or long-term conservation.

Conservation easements are a very important tool for the permanent conservation of lands. In essence, conservation easements are documents that identify the purposes for which the land(s) are being conserved and establish terms and conditions that identify permitted and restricted use of those lands that relate to the conservation purposes. The landowner serves as the "Grantor" of the easement and conveys it to a "Grantee," the person(s) or organization(s) that will receive the easement.

In contrast to land acquisition (or acquisition in fee), conservation easements can be purchased to remove development rights from the price of the land. This is a highly effective strategy for conserving important lands while continuing to keep them as part of a working landscape. In this way, the landowner receives a financial return on his/her land, the land is conserved for its natural resource and related public interest values, and it can remain in a working condition for forest products, agriculture, and other compatible enterprises. Conservation easements can be held by municipalities as well as state agencies,

land trusts, and other nonprofit organizations. The Vermont Land Trust and the Agency of Natural Resources are excellent sources of information on how to design and execute conservation easements.

Managing Town Highways

As previously noted, the link between infrastructure and development has been well documented. Arguably, no infrastructure decision has more of an effect on how and to what extent development proceeds than the town road network.

Municipalities may protect natural resources by choosing to create and maintain its major highway arteries away from natural resource areas. Accordingly, if municipal planning efforts indicate that significant natural resources exist off Class 4 highways (the lowest class of highway that require the least amount of town maintenance) use of these highways may be discontinued and/or turned into recreational trails (19 V.S.A. §§ 708-711). The adoption of policies to guide how such roads can be upgraded to serve development (i.e., new housing/subdivisions) can be an important means of managing fragmentation and protecting natural resources. For example, some communities treat Class 4 roads differently than other roads in zoning (e.g., by requiring frontage on class 3 or higher for development purposes). In this way, municipalities can direct development away from important natural resources while creating recreational opportunities for residents.

Impact Fees

Municipalities are authorized to charge developers impact fees to offset the cost of specific developments on increases in municipal facilities such as schools and utilities (24 V.S.A. § 5200 et seq.). The concept behind impact fees is that if a development adds people who will be using municipal services, the developer should be required to pay its proportional share for the increase in that service.

As an example, impact fees have been used to require developers whose projects will increase the use of municipal recreation areas, including town forests, to pay to expand or upgrade these areas. In this way, impact fees can be used to protect natural resources.

Impact fees are not used in many Vermont communities because the law requires a strict accounting of the fees. Because managing impact fees can be complicated, it is advisable to consult a planning consultant and/or an attorney beforehand.

Tree Wardens

The select board appoints the town's tree warden (24 V.S.A. 871). The tree warden has responsibility for shade and ornamental trees within the limits of public ways and places. He or she may plan and implement a shade tree preservation program, including planting and preservation, for the purpose of shading and beautifying public ways (24 V.S.A. 2502). Frequently, the tree warden is also the road commissioner, but the select board can appoint different individuals for each job and thus avoid a conflict between road maintenance and shade trees.

Municipal Forest

Each year at town meeting many towns vote on this particular issue: *"To see if the select board will acquire by gift or purchase land for a municipal forest to promote reforestation, water conservation, and good forestry practices."* A municipality may vote sums of money for the purchase, management, and improvement of a municipal forest in and outside of the municipality. A municipal forest may be devoted to producing wood products, maintaining wildlife habitat, protecting water supplies, providing forest recreation, and providing opportunities for conservation education (10 V.S.A. §§ 2651; 2652).

Conclusion

This section represents a summary of many of the steps local officials may take to protect and conserve natural resources. It is our hope that this manual will generate thinking about which of these tools is appropriate for use in your community as you evaluate the rich panoply of natural resources that exist throughout the state of Vermont in each and every city and town.

Endnotes

¹ “Conserved,” throughout this document, means legally protected from permanent alteration or development and includes both publicly and privately owned lands. Some conserved lands are managed as natural areas with limited resource extraction, whereas other conserved lands are managed sustainably as working forests or farms.

² Number is used only as an example.

³ These are areas identified by a town where growth and development is encouraged (similar to a growth center). The area, in other words, where development is sent.

⁴ This is a non-profit program that provides technical assistance to landowners interested in wildlife habitat improvement.

⁵ Number is used only as an example.

⁶ Typically, timber harvesting is not regulated. However, for lands that have been subject to certain regulatory jurisdictions, all future activities on those lands may be regulated.

⁷ There are many ways the results of the survey could be publicized; for example, in the newspaper or in a report which would be available to the public.

⁸ Under Vermont law, municipalities may have authority that deviates from the authority provided in state law if it adopts a local governance charter. Thirty-three municipalities in Vermont have governance charters. Some include minor deviations from the authority set forth in general Vermont law, while others, like Burlington and Brattleboro, provide for drastic differences in local governance. Adopting charter provisions is a method for municipalities to give itself greater authority to regulate any area, including protecting natural resources. The process for adopting or amending charters is set forth in 17 V.S.A. § 2645. The process is somewhat complex. It involves approval by both local governments and the state legislature. That is not to say the process should be avoided. Charters are the best tool available to Vermont municipalities to provide local control. Simply be aware of the nature of the process and consult a town attorney or the Vermont League of Cities and Towns to assist you in navigating the process to adopt or amend your municipal charter.

⁹ Local officials must either obtain the consent of private landowners to enter their land to conduct investigation or obtain a court order. Contact a town attorney if a landowner refuses permission to enter his/her property.

¹⁰ Planning grants are available to municipalities to hire consultants and/or undertake planning studies. To be eligible for planning grants, municipalities must at a minimum have a valid duly adopted town plan (a plan approved locally and by the Regional Planning Commission). For more information, see the website for the Vermont Agency of Commerce and Community Affairs.

¹¹ For a comprehensive explanation of Act 250, see the *Vermont Act 250 Handbook* by Cindy Corlett Argentine, published by Putney Press of Brattleboro, Vermont.

¹² Under 24 V.S.A. § 4385, a municipality may vote to have town plans approved by the voters. Absent such a vote, plans in both small and large municipalities are approved by the legislative body.

¹³ Town plans must be approved in order to apply under 19 V.S.A. § 1111. Approved plans must be in effect (not expired) and approved by the regional planning commission in accordance with 24 V.S.A. § 4350.

¹⁴ Under Vermont law, zoning and subdivision laws are referred to as both bylaws and regulations (24 V.S.A. § 4303(4)).

¹⁵ Zoning and subdivision bylaws are separate forms of land use regulation under Vermont law. In sum, zoning regulates structures and other improvements proposed for land development, whereas subdivision bylaws focus more on the division of the land itself. A municipality may adopt only zoning regulations, only subdivision regulations, or both.

¹⁶ Examples of uses and other bylaw provisions are just that — examples. The purpose of this chapter is not for you to adopt any of the examples. Consult your local and regional planning commission or VLCT for sample bylaws from other towns. Adopt bylaws that meet the needs and vision of your municipality as reflected in the town plan.

¹⁷ Contact your regional planning commission or VLCT for information on establishing ridgeline and other districts and to obtain sample bylaws from neighboring communities.

¹⁸ When creating such a buffer, it is vital to define how the buffer is measured (top of bank or center of stream) and how stream is defined. Contact the Water Quality Division of the Agency of Natural Resources for guidance on establishing buffers.

¹⁹ Under Vermont law, municipalities may choose to have a development review board that conducts all regulatory zoning reviews rather than have the regulatory reviews split between the planning commission and the zoning board of adjustment (24 V.S.A. § 4460). If a development review board is created, the planning commission still exists and retains all of its planning responsibilities.

²⁰ Site plan review may only apply to development other than one and two family dwellings (24 V.S.A. § 4416).

²¹ It is legal to have subdivision bylaws without zoning bylaws, and a few towns have chosen to do so.

²² The subdivision review is conducted by the planning commission and design review board and constitutes separate approval from the zoning permit that would also be required to divide the land. Please note that a municipality may elect to adopt a “unified bylaw” that combines at least zoning and subdivision bylaws (24 V.S.A. § 4419).

Bibliography and Works Cited

- Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*. 1987. Waterbury, VT: Vermont Agency of Natural Resources, Department of Forest and Parks.
- Andrews, J.S. 2002. *The Atlas of the Reptiles and Amphibians of Vermont*. Middlebury, VT: James S. Andrews.
- Argentine, C.C. 1999. *Vermont Act 250 Handbook*. Brattleboro, VT: Putney Press.
- Austin, J. 1999. Interdepartmental correspondence with Vermont Agency of Transportation.
- Austin, J. 2003. Interdepartmental correspondence with Wetlands Office.
- Burne, M.R. 2001. *Massachusetts Aerial Photo Survey of Potential Vernal Pools*. Westborough, MA: Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program. [includes CD]
- Calhoun, A.J.K. and M.W. Klemens. 2002. *Best Development Practices: Conserving Pool-breeding Amphibians in Residential and Commercial Developments in the Northeastern United States*. MCA Technical Paper No. 5. Bronx, NY: Metropolitan Conservation Alliance, Wildlife Conservation Society.
- Campoli, J., E. Humstone, and A. MacLean. 2001. *Above and Beyond: Visualizing Change in Small Towns and Rural Areas*. Chicago: American Planning Association Press.
- Chase, V., L. Demming, and F. Latawiec. 1995. *Buffers for Wetlands and Surface Waters: A Guidebook for New Hampshire Municipalities*. Concord, NH: Audubon Society of New Hampshire.
- A Classification of the Aquatic Communities of Vermont Aquatic Classification Work*. 1998. Montpelier, VT: The Nature Conservancy and the Vermont Biodiversity Project.
- Cowardin, L.M., et al. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. Washington, DC: Department of Interior, U.S. Fish and Wildlife Service.
- DeGraaf, R.M. and D.D. Rudis. 1986. *New England Wildlife: Habitat, Natural History, and Distribution*. General Technical Report NE-108. Newton Square, PA: Department of Agriculture, U.S. Forest Service, Northeast Forest Experiment Station.
- DeGraaf, R.M. et al. 1992. *New England Wildlife: Management of Forested Habitats*. General Technical Report NE-144. Amherst, MA: Northeast Experiment Station, U.S. Department of Agriculture, Forest Service.
- Doll, C.G., D.P. Stewart and P. MacClintock. 1971. *Surficial Geologic Map of Vermont. Vermont Geological Survey, Scale 1:250,000*. State of Vermont, Department of Environmental Conservation.
- Doll, C.W. et al. 1961. *Centennial Geologic Map of Vermont: Vermont Geological Survey, Scale 1:250,000*. State of Vermont, Department of Environmental Conservation.
- Doppelt, R., et al. 1993. *Entering the Watershed: A New Approach to Save America's River Ecosystems*. Washington, DC: Island Press.
- Elowe, K.D. and W. E. Dodger. 1989. "Factors Affecting Black Bear Reproductive Success and Cub Survival." *Journal of Wildlife Management*, 53:962-968.
- "Exploring Sprawl #6 – Economic, Social, and Land Use Trends Related to Sprawl in Vermont." 1999. Burlington, VT: Vermont Forum on Sprawl.
- Faccio, S.D. 2001. *Post-breeding Emigration and Habitat Use of Radio-implanted Jefferson and Spotted Salamanders at the Marsh-Billings-Rockefeller National Historical Park*. A Report to the Silvio O. Conte National Fish and Wildlife Refuge. Woodstock, VT: Vermont Institute of Natural Science.
- Ferguson, M. 2001. *Conserving Pool-specialist Amphibian Habitat*. Unpublished draft. Waterbury, VT: Vermont Agency of Natural Resources, Department of Fish and Wildlife, Nongame and Natural Heritage Program.
- Fish and Wildlife Considerations in Local Planning: A Vermont Review*. September 2002. Waterbury, VT: Agency of Natural Resources, Department of Fish and Wildlife.
- Fish Passage Design at Road Culverts: A Design Manual for Fish Passage at Road Crossings*. 1999. State of Washington, Department of Fish and Wildlife.
- Fish Passage Policy and Design Guide*. March 2002. State of Maine, Department of Transportation.
- "Fish-stream Crossing Guidebook." 2002. *Forest Practices Codes of British Columbia*. Victoria, BC: British Columbia Ministry of Forests. Available at <http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/guidetoc.htm>.
- Forman, R.T.T., et al. 2003. *Road Ecology – Science and Solutions*. Washington, DC: Island Press.
- Fowle, Suzanne. 2001. *Guidelines for Protecting Wood Turtles and Their Habitats in Massachusetts*. Westborough, MA: Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program.
- George, S., et al. 1998. *State Endangered Species Acts: Past, Present, and Future*. Washington, DC: Defenders of Wildlife.
- Hammond, F.M. 2002. "The Effects of Resort and Residential Development on Black Bears in Vermont." Final Report. Waterbury, VT: Fish and Wildlife Department, Vermont Agency of Natural Resources.
- Hunter, M.L., Jr. 1995. *Fundamentals of Conservation Biology*. Malden, MA: Blackwell Publishing.
- "Keeping in Touch" September 1999. U.S. Environmental Protection Agency, Vermont State Program Unit. Boston, MA: EPA Region 1 – New England.
- Kohm, K.A. and J.F. Franklin. 1997. *Creating a Forestry for the 21st Century: The Science of Ecosystem Management*. Washington, DC: Island Press.

- A Landowner's Guide to Building Forest Access Roads*. July 1998. U.S. Department of Agriculture, U.S. Forest Service, Northeastern State and Private Forestry. NA-TP-06-98. Available at <http://www.na.fs.fed.us/spfo/pubs/stewardship/accessroads/accessroads.htm>.
- Laughlin, S.B. and D.P. Kibbe. 1985. *The Atlas of Breeding Birds of Vermont*. Hanover, NH: University Press of New England.
- Litvaitis, J.A. 1999. "Early-Successional Forests and Shrub-Dominated Habitats: Land-Use Artifact or Critical Community in the Northeastern United States?" *Northeast Wildlife*, 54:101-118.
- Local Planning and Zoning Options for Water Quality Protection*. September 2001. Waterbury, VT: Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.
- MacArthur, R.H. and E.O. Wilson. 1967. *The Theory of Island Biogeography*. Princeton, NJ: Princeton University Press.
- "Southwest Stream Crossing Guidelines." December 29, 2003. National Marine Fisheries Service, Southwest Region. January 2, 2004. <http://swr.ucsd.edu/hcd/NMFSSCG.PDF>.
- Native Vegetation for Lakeshores, Streambanks, and Wetland Buffers: What You Need to Know to Re-establish or Enhance a Buffer Strip Along Water and Wetlands in Vermont*. 1996, 2nd printing. Waterbury, VT: Agency of Natural Resources, Department of Environmental Conservation.
- Noss, R.F. and A.Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Washington, DC: Island Press.
- Payne, N.F. and F.C. Bryant. 1994. *Techniques for Wildlife Habitat Management of Uplands*. New York, NY: McGraw Hill.
- Personal correspondence. 1999. John Austin, Fish and Wildlife Department, and John Narowski, Vermont Agency of Transportation.
- Personal correspondence. 2003. John Austin, Fish and Wildlife Department, and Alan Quackenbush, Wetlands Office, Vermont Agency of Natural Resources.
- "Procedure on ANR Floodway Determination in Act 250 Proceedings." Available at www.vtwaterquality.org/riversmtg.htm. Waterbury, VT: Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.
- Reay, R.S., et al. 1990. *Management Guide for Deer Wintering Areas in Vermont*. Waterbury, VT: Vermont Department of Fish and Wildlife, Forests, Parks & Recreation.
- Riparian and Lakeshore Buffer Procedure Technical Papers*. 2002. Waterbury, VT: Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.
- Robison, E.G., A. Mirati and M. Allen. Spring 1999. *Oregon Road/Stream Crossing Restoration Guide*. Available at <http://www.nwr.noaa.gov/1salmon/salmesa/4docs/orfishps.htm>
- Rogers, L.L. 1976. *Effects of Mast and Berry Crop Failures on Survival, Growth, and Reproductive Success of Black Bears*. Transcript from the North America Wildlands and Natural Resources Conference, 41:432-438.
- Saving Our Open Landscape: Effects of Development and Sprawl on Vermont's Fish and Wildlife*. 2000. Waterbury, VT: Vermont Natural Resource Agency, Department of Fish and Wildlife.
- Schueler, T.R. 1994. "The Importance of Imperviousness." *The Practice of Watershed Protection Techniques*, 1(3):100-111.
- Semlitsch, R.D. 1998. "Biological Delineation of Terrestrial Buffer Zones for Pond-Breeding Amphibians." *Conservation Biology*, 12:1113-19.
- Semlitsch, R.D., 25 December 2002, online date. "Biological Delineation of Terrestrial Buffer Zones for Pond-Breeding Amphibians." *Conservation Biology*. Available at <http://www.blackwellsynergy.com/servlet/useragent?func=synergy&synergyAction=showTOC&journalCod=cbi&volume=12&issue=5&year=1998&part=null>.
- "State and County Quick Fact" (Vermont). July 15, 2003. U.S. Census Bureau. Available at <http://quickfacts.census.gov/qfd/states/50000.html>.
- "Technique Guidance for Determining Floodway Limits Pursuant to Act 250 Criterion 1(D)." Available at www.vtwaterquality.org/riversmtg.htm. Waterbury, VT: Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.
- Thompson, E.H., and E.R. Sorenson. 2000. *Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont*. Montpelier, VT: The Nature Conservancy and Vermont Department of Fish and Wildlife. Distributed by University Press of New England, Hanover, NH.
- Thompson, E.H. 2002. *Vermont's Natural Heritage: Conserving Biological Diversity in the Green Mountain State: A Report from the Vermont Biodiversity Project*. Montpelier, VT: The Nature Conservancy.
- Tiner, R.W. 1987. *Preliminary National Wetlands Inventory Report on Vermont's Wetland Acreage*. Washington, DC: Department of the Interior, U.S. Fish and Wildlife Service.
- Vermont Better Back Roads Manual: Clean Water You Can Afford*. November 1995. Brattleboro, VT: Windham Regional Commission and the George D. Aiken & Northern Vermont Resource Conservation and Development Councils.
- Vermont Stream Geomorphic Assessment: Protocol Handbooks*. Available at www.vtwaterquality.org/riversmtg.htm. Waterbury, VT: Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.
- Verry, E.S., et al. 2000. *Riparian Management in Forests of the Continental Eastern United States*. Washington, DC: Lewis Publishers.
- Wildlife Habitat Management for Vermont Woodlands*. 1995. Waterbury, VT: Vermont Agency of Natural Resources, Departments of Fish and Wildlife and Forests, Parks and Recreation.

Appendix

I. Planning

The following agencies and organizations are especially well suited to help towns and other groups develop good local plans and to implement them with sound conservation strategies.

Vermont Planning Information Center

Presented by the Land Use Education and Training Collaborative, this site provides information for planning commissions, zoning boards, development review boards, zoning administrators, and their staff, including links to some of the other organizations and publications mentioned in this document.

Website: <http://www.vpic.info>

Regional Planning Commissions

Vermont has 11 Regional Planning Commissions, each governed by a Board of Directors composed of representatives from the member municipalities. Staffed with professionals in environmental/land use planning, geographic information systems (GIS), transportation planning, economic development and similar disciplines, these quasi-governmental, nonprofit Commissions provide technical guidance and support services to their member municipalities and the public. Their primary role is to provide technical assistance in writing town plans and zoning ordinances. The Vermont Association of Planning and Development Agencies (website address below) provides more detailed information and links to each of the 12 RPCs.

Website: <http://www.vapda.org>

Agency of Commerce and Community Development Vermont Department of Economic, Housing & Community Development

The DHCA issues planning grants to municipalities. The grants may be used to hire consultants to work with towns to update town plans and craft bylaws, including bylaws designed to protect natural resources.

1 National Life Drive
Montpelier, VT 05620

Phone: 802-828-3080

Website: <http://accd.vermont.gov/business>

Vermont League of Cities and Towns

Founded in 1967, VLCT is a non-partisan, nonprofit organization owned by Vermont's municipal governments. The League provides educational, legislative, and insurance trust services, as well as legal advice, to all political subdivisions of the state of Vermont.

89 Main Street, Suite 4
Montpelier, Vermont 05602-2948

Phone: 802-229-9111

Website: <http://www.vlct.org>

Vermont Natural Resources Council

VNRC provides education, technical assistance and advocacy in the areas of: Energy and Climate Change, Forests and Wildlife, Water, and Sustainable Communities, offering a valuable multi-disciplinary approach to their work.

9 Bailey Avenue
Montpelier, VT 05602

Phone: (802) 223-2328

Website: <http://www.vnrc.org/>

II. Conservation, Science and Mapping

The following organizations are especially well-suited to provide natural heritage data and to help users interpret those data. See also Section III on page 134.

Association of Vermont Conservation Commissions

The Association of Vermont Conservation Commissions fosters local conservation commissions in the stewardship of Vermont's natural resources. Over one third of Vermont municipalities have established conservation commissions or similar committees (see 24 V.S.A. Chapter 118 for more information).

Website: <http://www.vtconservation.org>

Audubon Vermont

Protecting birds, other wildlife, and their habitat by promoting a culture of conservation through education, research, and advocacy.

255 Sherman Hollow Road
Huntington, VT 05462

Phone: 802-434-3068

Website: <http://vt.audubon.org>

Bat Conservation International

The mission of Bat Conservation International is to protect and restore bats and their habitats worldwide.

P.O. Box 162603
Austin, TX 78716
512-327-9721

Website: <http://www.batcon.org>

Keeping Track[®], Inc.

Keeping Track is an organization that teaches people to observe, interpret, record, and monitor evidence of wildlife in their communities, and to support citizens' use of monitoring data in local and regional conservation planning. Information collected by citizens who have been educated by the Keeping Track program may allow communities to document presence of certain wildlife species and important habitats.

This information may be useful to inform local conservation planning activities, monitor changes in wildlife populations over time and space, and support land protection projects. The data may also help communities understand the degree to which certain areas are important to the well-being of wildlife populations.

P.O. Box 444
Huntington, VT

Phone: 802-434-7000

Website: <http://www.keepingtrack.org/>

NatureServe

General information on the conservation status and distribution maps of many native plants, animals, and natural communities throughout the United States.

4600 N. Fairfax Dr., 7th Floor
Arlington, VA 22203

Phone: 703-908-1800

Website: <http://www.natureserve.org>

Vermont Center for Geographic Information

This is the primary source for digital map data on Vermont. Data range from basic things such as roads and town boundaries to complex analyses such as landforms and core forest. Many data layers can be downloaded for use with ArcView or other GIS software; others are available only on CD.

58 South Main Street, Suite 2
Waterbury, VT 05676

Phone: 802-882-3000

Website: <http://www.vcgi.org>

Vermont Center for Ecostudies

Breeding Bird Atlas

VCE are an innovative, independent research group dedicated to the understanding and conservation of birds and other wildlife.

PO Box 420
Norwich, VT 05055

Phone: 802.649.1431

email: info@vtecostudies.org

Website: <http://www.vtecostudies.org/vbba/>

Vermont Local Roads Program

The Vermont Local Roads Program at Saint Michael's College is part of the Local Technical Assistance Program (LTAP), a nationwide effort financed jointly by the Federal Highway Administration and individual state departments of transportation. Its purpose is to provide road and bridge know-how to municipal people involved with highways.

Saint Michael's College
One Winooski Park, Box 260
Colchester, VT 05439

Phone: 802.654.2652

Website: <http://www.vermontlocalroads.org/>

Vermont Reptile and Amphibian Atlas

Distribution information, by town, on all Vermont's reptile and amphibian species based on sightings, photographs, and specimens. This information is regularly updated by professionals and trained volunteers. Training for volunteer participation in surveying is available and encouraged. The Atlas can be ordered in hard copy or viewed online.

James S. Andrews
The Vermont Reptile and Amphibian Atlas Project
642 Smead Road
Salisbury, VT 05769

Phone: (802) 352-4734

email: jandrews@middlebury.edu

Website: <http://community.middlebury.edu/~herpatlas/>

U. S. Environmental Protection Agency

Mission: to protect human health and to safeguard the natural environment.

EPA New England, Region 1
5 Post Office Square – Suite 100
Boston, MA 02109-3912

Phone: (617) 918-1111

Website: <http://www.epa.gov/epahome/index.html>

U. S. Fish and Wildlife Service

Managing Missisquoi National Wildlife Refuge, Silvio O. Conte National Fish and Wildlife Refuge, Pittsford National Fish Hatchery, and Bethel National Fish Hatchery. Leading the Lake Champlain Ecosystem Team from offices in Essex. The program offers financial and technical assistance to private landowners for fish and wildlife habitat restoration conducted on private lands.

Lake Champlain Fish and Wildlife

Resources Office

Winston Prouty Federal Building

11 Lincoln Street

Essex Junction, VT 05452-3151

Phone: (802) 872-0629

Website: <http://northeast.fws.gov>

U.S. Forest Service, Green Mountain National Forest

Managing lands in the Green Mountains and Taconic Mountains.

231 North Main Street

Rutland, VT 05701

Phone: 802-747-6700

Website: www.na.fs.fed.us/pubs/

There are tools here to help locate resources on everything from forested wetlands to writing stewardship plans. One publication aimed at community projects you will find there is *Landscape Stewardship Guide* (na-in-06) na.fs.us/pubs/stewardship-guide

Vermont Geological Survey

The Survey has information on bedrock and surficial geology statewide.

Website: <http://www.anr.state.vt.us/dec/geo/vgs.htm>

III. Getting Help

The following state and federal agencies provide a diversity of services, from data and technical assistance to regulatory functions.

Vermont Agency of Natural Resources

The mission of the Vermont Agency of Natural Resources is: "To protect, sustain, and enhance Vermont's natural resources: for the benefit of this and future generations." The following departments are under the administration of ANR. All of the following departments are located at the address below unless otherwise noted.

1 National Life Drive, Davis Building

Montpelier, VT 05620

Website: <http://www.anr.state.vt.us>

Vermont Department of Environmental Conservation

DEC administers most of ANR's regulatory programs plus several voluntary pollution and waste reduction programs. Program areas include: air quality, environmental assistance, public facilities engineering, geology, environmental permits, solid waste, hazardous waste, surface water quality, watershed planning, stormwater management, drinking water supply.

Phone: 802-828-1535

Website: <http://www.anr.state.vt.us/dec/dec.htm>

Watershed Management Division

The goal of the Water Quality Division is to maintain and enhance the quality of Vermont's lakes, rivers, and wetlands to support healthy ecosystems and appropriate public uses. The Division provides assistance to municipalities and individuals to meet this goal, including administering several grant programs. A large division with programs in Biomonitoring and Aquatic Studies, Hydrology, Lakes and Ponds Management and Protection, River Corridor Management, Stormwater, and Wetlands.

Phone: 802.338.4846

Website: <http://www.vtwaterquality.org/wqdhome.htm>

Vermont Department of Forests, Parks and Recreation

Operates the Vermont State Parks system, manages state forests and natural areas, and provides assistance in the areas of forestry, recreation, and conservation education.

1 National Life Drive, Davis 2 Building

Montpelier, VT 0562003801

Phone: 802-828-1534

Website: <http://www.vtfpr.org/>

See: Vermont Forest Resources Plan State Assessment and Resource Strategies

The Vermont Town Forest Stewardship Guide:

A Community Users' Manual for Town Forests

([www.communitiescommittee.org/pdfs/](http://www.communitiescommittee.org/pdfs/TownForestStewardshipGuide.pdf)

[TownForestStewardshipGuide.pdf](http://www.communitiescommittee.org/pdfs/TownForestStewardshipGuide.pdf))

Vermont Fish and Wildlife Department

Manages Vermont's fisheries and wildlife resources, enforces the state's hunting and fishing laws, and studies and inventories nongame wildlife species and natural communities. Department staff can assist planners in interpreting and applying the information presented in this manual.

Phone: 802-241-3700

Website: <http://www.vtfishandwildlife.com/>

Community Wildlife Program

Website: http://www.vtfishandwildlife.com/cwp_home.cfm

Natural Heritage Inventory

Keeps track of information on rare species and significant natural communities throughout the state. Lists of rare plants and animals are available on the NNHP website.

Phone: 802-241-3700

Website: http://www.vtfishandwildlife.com/wildlife_nongame.cfm

Lake Champlain Basin Program

The Lake Champlain Basin Program (LCBP) is a federal, state, and local initiative to restore and protect Lake Champlain and its surrounding watershed for future generations.

54 West Shore Road
Grand Isle, Vermont 05458

Toll-free: 1-800-468-5227

Website: <http://www.lcbp.org>

Natural Resources Conservation Service

A locally guided federal agency that is responsible for helping Vermonters to manage and sustain their natural resources. NRCS administers the Wildlife Habitat Incentives Program (WHIP), which offers financial and technical assistance to private landowners for fish and wildlife habitat restoration conducted on private lands. There are 10 field offices throughout the state.

356 Mountain View Dr., Suite 105
Colchester, VT 05446

Phone: 802-951-6795

Website: <http://www.vt.nrcs.usda.gov>

Vermont Agency of Transportation (VTTrans) Enhancement Program

The Enhancement Program provides funding to municipalities, state agencies, non-profit organizations, and federal agencies for surface transportation-related projects. One of the 12 eligible activities covered under this program is "Environmental Mitigation to Address Water Pollution Due to Highway Runoff or Reduce Vehicle-Caused Wildlife Mortality While Maintaining Wildlife Habitat Connectivity."

Local Transportation Facilities

1 National Life Drive
Montpelier, VT 05603

Phone: (802) 828-2657

Website: <http://www.aot.state.vt.us/progdev/Sections/LTF%20Info/EnhansAbout62011.htm>

IV. Land Acquisition and Conservation Easements

Land trusts are primarily involved in protecting land through acquisition or through conservation easements. The more local the land trust, the more likely it is to be able to help you conserve land in your community.

Lake Champlain Land Trust

Working to permanently conserve Lake Champlain islands and shoreline.

One Main Street
Burlington, VT 05401,

Phone: (802) 862-4150

Website: <http://www.lclt.org>

Middlebury Area Land Trust

MALT conserves, promotes, and manages land as natural, open, and working landscapes in Addison County.

P.O. Box 804
Middlebury, VT 05753

Phone: (802)388-1007

Website: <http://www.maltvt.org/>

The Nature Conservancy

The Nature Conservancy's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. The Nature Conservancy owns more than 30 nature preserves throughout Vermont, and has worked to plan for the conservation of biological diversity in three ecoregions that include Vermont.

27 State Street
Montpelier, VT 05401

Phone: 802-229-4425

Website: <http://nature.org>

See: *Best Management Practices for the Prevention and Treatment of Terrestrial Invasive Plants in Vermont Woodlands*, The Nature Conservancy (www.nature.org/Vermont/weeds)

Northern Rivers Land Trust

Northern Rivers Land Trust (NRLT), representing seven neighboring towns, Albany, Craftsbury, Greensboro, Hardwick, Walden, Wolcott and Woodbury, is dedicated to protecting the natural, scenic, and working landscapes in the headwaters of the Winooski, Lamoille, and Black Rivers.

P.O. Box 112
Hardwick, Vermont, 05843

Website: <http://www.northernriverslandtrust.org/>

Continued

Trust for Public Lands

TPL helps conserve land for recreation and spiritual nourishment and to improve the health and quality of life of American communities.

Vermont & New Hampshire Office

3 Shipman Place

Montpelier, VT 05602

Phone: (802) 223-1373

Website: <http://www.tpl.org/what-we-do/where-we-work/vermont/>

Vermont Housing and Conservation Board (VHCB)

The Vermont Housing and Conservation Board is an independent, state-supported funding agency providing grants, loans, and technical assistance to nonprofit organizations, municipalities, and state agencies for the development of perpetually affordable housing and for the conservation of important agricultural land, recreational land, natural areas, and historic properties in Vermont.

58 East State Street

Montpelier, VT 05602

Phone: 802-828-3250

Website: <http://www.vhcb.org>

Vermont Land Trust

The Vermont Land Trust works throughout the state to conserve land for the future of Vermont. It holds easements on farms and forests throughout Vermont.

8 Bailey Avenue

Montpelier, VT 05602

Phone: 802-223-5234

Website: <http://www.vlt.org>

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Conserving Vermont's Natural Heritage

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Community-Based Planning
for the Conservation of
Vermont's Fish, Wildlife,
and Biological Diversity*

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