

Chapter 2

Vermont Overview

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Vermont Overview

Vermont Cares about Wildlife Conservation

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 rate, 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 2011 public opinion survey results from the U.S. Fish and Wildlife Service, Vermont ranked first in the nation in percentage of residents that actively observed wildlife (53%). The results also show that resident and non-resident hunting, fishing, and wildlife viewing expenditures in Vermont totaled \$704 million. These statistics represent a significant contribution to the state’s economy and underscore the strong connection Vermont residents and non-residents with the land and wildlife.

Vermont’s natural diversity, 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, hunt, fish, trap, watch wildlife, hike and work the land.

The Vermont Landscape—an Overview

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. These factors that comprise and influence the Vermont landscape and subsequently the flora and fauna of the state are explained below.

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 juts to 4,393 feet. The distance between Lake Champlain and the summit of Mount Mansfield is only 20 miles, but in that short distance, the climate, topography, and vegetation change considerably. On warm limy sites in the Champlain Valley, where the growing season is 150 days, shagbark hickory trees grow. Apple orchards are common in this environment as well as dairy farming due to the influence of climate on growing season. On the summit of Mount Mansfield,

where the growing season is limited to 90 days, red spruce and balsam fir grows in stunted and contorted mats, bending to the direction of incessant winds.

Climate is major factor in determining the distribution of natural communities, habitats, plants and animals. Elevation provides a means for understanding the influence of climate on wildlife and habitats in Vermont because climate changes in relatively short distances with change in elevation. Thus, climate's effect on biota can easily be observed.

Geology

Vermont's bedrock composition is varied and thus, Vermont's soils, hydrology, and subsequently plant distribution and abundance vary. The variations influence, in part, wildlife and plant distribution. The rocks comprising 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, including the stone that makes up the Barre granite quarries. These rocks were formed 200 to 400 million years ago because of deep underground magma welling up and hardening.

Whether the bedrock is limestone or granite (or other type) is particularly important in the distribution of natural communities and plants because each rock type has its own particular physical and chemical composition. For instance, rich fens, a rare type of wetland with plants that require high levels of calcium, occur almost exclusively in areas where limestone or similar calcium-rich rock is found.

Vermont's surficial geology is defined by the sands, gravels, clays, peats, and other deposits found on top of the bedrock. They are a result of both glacial activity and post-glacial events (such as flooding) that continue today. Bedrock and surficial geology together have a profound influence on the soils in which Vermont's plants grow.

Topography

Topography describes the physical landscape and influences the distribution of plants, animals, and natural communities. The soil on the top of a mountain tends to be shallow and dry, whereas the soil at the base of a slope tends to be deep, moist, and rich in organic matter because of the downslope movement of plant litter and soil. Cliffs, for example, offer a specialized habitat for specialized groups of plants, as well as denning habitat for Bobcat and nesting sites for Peregrine Falcon. Certainly, topography influences the quality and distribution of winter habitat for White-tailed Deer in Vermont.

Hydrology

Water and its movement have a profound influence on animals, plants and 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 low-lands 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.

Land Use History

Land use history has influenced the distribution of plants and animals across Vermont. For instance, the degree and type of forest cover have a great influence on the species that occur in an area. Vermont has more forest today (75%) than it had in the mid-1800s (25%), and the effect of this change on wildlife has been dramatic. Additionally, Vermont's agricultural activity also affected the soils and the plants that grow in them.

Biophysical Regions of Vermont

The five factors described previously combine to create nine distinct biophysical regions. It is important to consider Vermont's biophysical regions when assessing and planning for the conservation of wildlife (Fig 2.1). For example, what may be a common species in one biophysical region may be rare in another, thus, increasing the importance of conserving habitat for that species in the region in which it is rare. Vermont's biophysical regions are described below.

Northeast 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, 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 dotted with a few dominant peaks and several ski areas. Climate is cold and rainfall is relatively high. Northern hardwoods, spruce, and fir dominate, and there are many 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 side slopes, whereas high elevations

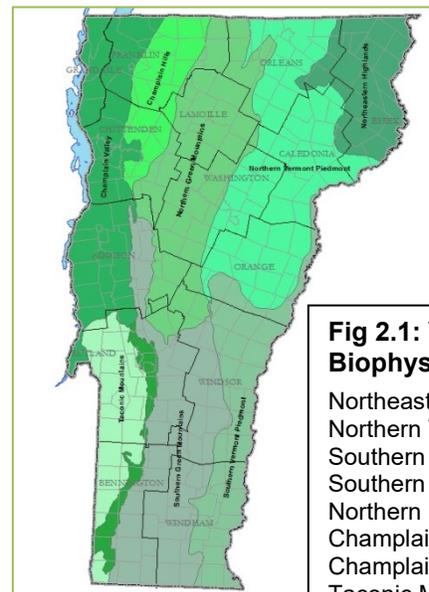


Fig 2.1: Vermont Biophysical Regions

Northeastern Highlands
Northern VT Piedmont
Southern VT Piedmont
Southern Green Mountains
Northern Green Mountains
Champlain Hills
Champlain Valley
Taconic Mountains
Vermont Valley

have spruce and fir as well as Alpine meadow habitat. Twenty-six percent of the region is conserved.

Champlain Hills: This region is transitional between the Champlain Valley and the Northern Green Mountains. Northern Hardwood Forests dominate on the low hills, but oak-pine forests extend up the major river valleys where there are warmer conditions.

Champlain Valley: This region of Vermont has a warm climate and abundant fertile farmland. The Champlain Valley contains both northern hardwood forest and various species of oaks and hickory. It has some of the state's most significant natural diversity, and 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 found in this region. 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.

Vermont's Landscape—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. During the 17th and 18th centuries, land was cleared for the development of agricultural economies. By the mid-1800s, 75% of Vermont's forests were cleared for agriculture, and in particular, sheep farming. These changes affected the state's waters, forests, and wildlife. Even some wildlife species, such as beaver and deer, that had been common, nearly disappeared from the land. As other influences caused people to begin to move towards the western United States, lands were abandoned and forests began to regenerate.

With the return of the forest and the work of the Vermont Fish & Wildlife Department and partners the recolonization and reintroduction of animal species, Beaver, White-tailed Deer, Wild Turkey, Fisher, and others that had declined have now returned and are today abundant. These species and others stand as 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. The Passenger Pigeon, for instance, is now extinct, and some large predators such as wolves and mountain lions that once roamed the New England forests, are no longer present.

Vermont's Contemporary Land Use

Agriculture and forestry still support Vermont's economy in significant ways. These elements of Vermont's business and economic communities offer great opportunities for wildlife conservation because they allow private landowners to realize a financial return from their land while keeping the land in an undeveloped or natural condition. Many of these land-based business interests are excellent stewards of the land and wildlife.

Vermont non-industrial forestland owners have a long history of active engagement in the management of forest resources throughout the state. Since the advent of the [Vermont Use Value Appraisal Program](#) (a.k.a. Current Use Program) 16,000 landowners have brought more than 1.8 million acres of forestland under forest management. A 2008 update to the program now allows landowners to enroll lands as Ecologically Significant Treatment Areas rather than for timber production, if they support natural communities and wildlife habitats of statewide significance; rare, threatened, and endangered species; some riparian areas; vernal pools with amphibian breeding habitat; forested wetlands; and old forests. More than 2,800 acres are enrolled as Ecologically Significant Treatment Areas.

Many of Vermont forestland owners manage their lands for wildlife and forest resources and seek to enhance their management skill through their involvement in non-profit organizations advocating sustainable forest management such as [Vermont Coverts: Woodlands for Wildlife](#), [Vermont Woodlands Association](#), [Vermont Family Forests](#) and [Audubon Vermont's Forestry for the Birds](#) program. These stewards provide strong examples of Vermonters taking steps to conserve our wildlife resources.

Based on data from the U.S. Census Bureau's 2014 the population estimate, 626,562 people live in Vermont, an increase of 0.1% since 2010. While Vermont is considered the most rural of northeastern states, there is an increasing demand for residential and commercial development. The rate of development in Vermont is double the rate of population growth (Center for Rural Studies 2008) and this growth is occurring mostly in rural communities. Like other New England states, residential development is often dispersed in rural and suburban areas rather than in existing village and urban communities.

Parcelization describes the subdivision of land into smaller and smaller forested area and multiple ownerships--typically by roads, agriculture, utility corridors, subdivisions or other human development. This phenomenon drives habitat fragmentation that has been shown to reduce forest and habitat health, water quality and the sustainability of local forest product economies (VFPR 2015). With Vermont's population projected to increase by 85,000 in the next 15 years, the Vermont Forests, Parks & Recreation Department is leading efforts to balance population growth with Vermonters' interests in maintaining healthy forests and wildlife habitat, clean water and the state's traditional settlement pattern of village centers surrounded by fields, farms and working forests (VFPR 2015). Since 2006 the Vermont Natural Resources Council has hosted the [Vermont Forest Roundtable](#), a venue for information exchange among consulting foresters, professional planners, state agency officials (including VFWD and VFPR), landowners, sportsmen, forest products industry representatives, conservation groups, biomass energy organizations and academics. Addressing parcelization drivers has been a primary Roundtable focus.

Contemporary Problems and Threats to Vermont's Wildlife

The problems most frequently identified as impacting SGCN are loss of habitat (due to conversion, degradation, fragmentation and lack of needed successional stages), the impacts of roads and transportation systems, pollution and sedimentation, invasive species and climate change. Additionally, wildlife diseases and the decline of pollinators have been gaining greater attention in both the scientific community and among Vermonters in general. Each is summarized here:

Loss of Habitat: Due to Degradation, Conversion, Fragmentation or Lack of Needed Successional Stages

These four categories are not mutually exclusive and problems can often logically be placed into more than one category depending on the stress it causes for a species or habitat.

Habitat Conversion: The complete transformation or loss of a habitat by human action (examples include: filling a wetland to create a grassy field, converting a forest stand into a parking lot, or damming a stream to create a reservoir). Though many agencies and organizations work diligently to conserve important wildlife habitats, Vermont continues to lose approximately 4,800 acres of habitat each year to regulated development alone. According to the Vermont Environmental Board, regulated development in Vermont constitutes approximately one-third of the total development that occurs on an annual basis. Important habitats addressed by various statutes, largely Act 250, and include deer winter habitat, wetlands with significant wildlife functions, habitat for rare, threatened and endangered species and several types of habitat necessary for the survival of black bears. These habitats represent only a few of the many habitats that are affected by loss due to development.

Habitat Alteration/Degradation: A lessening of the quality of a habitat by human action stopping short of complete conversion (examples include: the reduction of mast (fruit and seed) production in a forest stand, riprapping a streambank, and significant land use changes adjacent to a habitat such as replacing a forest stand on the edge of a wetland with a housing development).

Habitat Fragmentation: The breaking up of habitats into smaller, non-contiguous patches because of habitat conversion (e.g., housing, commercial development, roads, utility lines). Fragmentation can: 1) render important habitats inaccessible (such as isolating a den site from a feeding site), 2) isolating populations (for example grassland butterflies, spotted salamander, and tiger beetles); and, 3) degrade remaining habitat patches through edge effects that favor edge-tolerant species such as raccoons and crows, as well as invasive exotic species that can out-compete native and rare species. The result of habitat fragmentation is often increased predation, increased mortality, reduced mobility and changes in habitat micro-climates. In the past decade, fragmentation research and efforts to maintain and restore habitat connectivity have increased significantly in Vermont and elsewhere. It's also a problem for forestry and rural economies (VFPR 2015).

Inadequate Distribution of Successional Stages: The lack of either late, mid or early successional habitat in appropriate patch size and/or juxtaposition can be a problem for some SGCN especially as fragmentation makes it harder for species to move between forest patches (examples include ruffed grouse and woodcock which prefer early successional forest stands, American marten which prefers late-successional stands and Canada Lynx and Snowshoe Hare which depend on a mix of forest stages).

Climate Change

Long-term changes linked to global warming and other climate issues are expected to drive major changes in habitat availability (e.g., high elevation habitats, wintering areas and migration stopovers) (Glick 2005), vegetative composition and location (e.g., the movement

up in elevation or north in latitude, invasion by exotic pests), climate variability (e.g., change in snow depth, rainfall and/or natural disturbances). Many specific details as to how climate change is affecting Vermont's wildlife today remain unknown, but the pervasiveness and scale of the problem requires that we begin planning to address it now. Chapter three of this Wildlife Action Plan dives deep into the Climate Change threat.

Impacts of Roads and Transportation Systems

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 (VTTrans) (1999). Transportation systems can cause numerous problems for SGCN including: vehicle-wildlife collisions; reducing animal and fish passage, thus limiting habitat availability and isolating populations; vehicle emissions of pollutants such as ozone and greenhouse gases; and facilitating the spread of an exotic, invasive species into otherwise healthy areas. To address problems such as these, VFWD and VTTrans established a joint Wildlife-Transportation Steering Committee in 2007 to guide and support interagency cooperation to make Vermont's transportation system safer for both people and wildlife. VTTrans is now considered a leader nationally among transportation agencies in road ecology.

Pollution & Sedimentation

The introduction of exotic materials from point and non-point sources can significantly impact SGCN, particularly aquatic species. Pollutants and sediments include sands and silts, chemicals and toxins; excess nutrients from farm and municipal sewage plants; garbage and other solid waste; radioactive materials; road salt; excessive noise; excessive heat; and light pollution that disturbs animals and disrupts migration patterns. Sediments can be a problem for SGCN through their physical presence alone. For example, soils can wash into a stream from a construction site and smother fish eggs and other aquatic species living in the spaces between rocks and gravel streambed. The history of polluted runoff—rainwater and snowmelt draining from parking lots, roads and streets, logging roads, farm fields and croplands, and lawns—carrying sediments and nutrients, including phosphorus, into streams and rivers and directly into Lake Champlain is stimulating excessive growth of algae which is bad for lake species and people. The status of efforts to reduce the amount of pollutants getting into the lake can be found at [Restoring Lake Champlain](#).

Invasive Exotic Species

The introduction and spread of invasive exotic and native species (plants and animals) may lead to the elimination of native wildlife populations, threaten long-term stability of habitats and even lead to extirpation through disease, by out-competing a native species, displacing its food source or altering a key process or function of a habitat. Invasive exotic species in Vermont include Eurasian watermilfoil, purple loosestrife, common buckthorn, Japanese knotweed, Morrow's honeysuckle, goutweed, black swallow-wort, hemlock woolly adelgid rusty crayfish, alewife and zebra mussels.

Since the 2005 Wildlife Action Plan was released, the ecological and economic problems caused by invasive exotic species have gained much more attention in Vermont. A clearinghouse of information and resources to help map, assess and combat the introduction and spread of these species is now available at [VTInvasives.org](#). (vtinvasives.org). VDEC's [Aquatic Invasive Species Program](#) coordinates management activities associated with aquatic invasive and nuisance species. And, the state has an [Invasive Forest Pest Action Plan](#) ready

for the eventual arrival of forest pests, including the Asian long-horned beetle and emerald ash borer, in order to prevent the establishment and/or limit their spread within Vermont ([VFPR/VAAFPM 2014](#)).

Diseases

Shortly after the first Wildlife Action Plans were submitted, White-Nose Syndrome (WNS) was discovered in New York and then Vermont in 2008 followed quickly by several other states. In a few short years WNS nearly wiped-out several bat populations in the Northeast. The Little Brown and Northern Long-eared Bats, decimated by the disease were added to Vermont's endangered species list and the Northern Long-eared bat was listed federally as threatened in 2015. The threat caused by WNS was added as an 'emerging issue' to the Action Plans of several states, including Vermont's. Subsequently, Snake Fungal Disease was discovered killing Rattlesnakes in Vermont and elsewhere, and *Heterosporis* appeared in Yellow Perch in Lake Champlain. Additionally, diseases not yet found in Vermont are potential threats. They include: Chronic Wasting Disease (deer), Viral Hemorrhagic Septicemia (fishes), *Batrachochytrium salamandrivorans* (salamanders) and Avian Influenza (birds). The Vermont Fish & Wildlife Department has steadily increased surveillance and is devoting additional resources to the threats posed by these and other diseases.

The Vermont Fish & Wildlife Department developed a fish health and biosecurity program to reduce the risk of disease importation and spread that includes strict regulations for fish importation, the prohibition of live transfer of fish from one body of water to another, strict baitfish use regulations, the use of water filtration and disinfection equipment at fish culture station water source(s), regular use of disinfectants at fish culture stations and health inspections of both naturally produced fish and fish produced at fish culture stations. The Department works in close coordination with its counterparts in the northeast states through the [Northeast Fish Health Committee](#) to develop and share procedures and protocols to maintain fish health and reduce the threat and movement of fish diseases.

VFWD also strictly controls access to bat hibernacula to prevent the spread of WNS and has regulations governing the movement of rabies vector species as well as rules to help prevent the introduction of Chronic Wasting Disease into the state. The VFWD, collaborates regionally through the [Northeast Wildlife Disease Cooperative](#), a consortium of states and veterinary diagnostic laboratories providing wildlife diagnostic services, expertise, training, and research support to state and federal wildlife agencies in the region.

The Forests, Parks & Recreation Department's [Forest Health](#) program monitors tree and forest condition statewide. The survival of tree species, in some cases entire genera, is at stake when non-native insects and diseases arrive in locations where they have no natural enemies and their tree hosts have no resistance. Some threatened species, including hemlock, beech, and ash, are currently an integral part of the state's forests. Others, including native red pine and flowering dogwood, are already uncommon. Conservation planning can identify individual trees or forest stands to be protected, and the best strategies to use while limiting impacts to non-target species. Other tree species are already decimated by pests that are well established in Vermont, including Dutch elm disease, chestnut blight, and butternut canker.

Pollinators

While the 2005 Wildlife Action Plan included 33 species of butterflies and moths, many of them pollinators, their role as pollinators was not critical to their selection as SGCN. Since 2005, concerns over the status of pollinators in general (e.g. flies, wasps, moths, butterflies, beetles, bees, bats and hummingbirds), and native bees in particular, has become a worldwide concern. Pollination is defined as a mutually beneficial relationship between plants and pollinators wherein the plant provides pollen and/or nectar to the pollinator and the pollinator provides reproductive services for the plant (National Research Council, 2007). Roughly 75 percent of the 240,000 species of flowering plants world-wide rely on pollinators for flower reproduction (NRC, 2007). This includes many plant species that provide browse or forage for larger wildlife, as well as seeds and fruits to support birds and small mammals. These invertebrates also pollinate many commercial crops. In Vermont this includes blueberries, tomatoes, squash, apples, and other produce. The many drivers of pollinator declines include habitat loss and degradation, intensive agricultural practices, use of certain pesticides, diseases and pathogens (Heinz Center, 2013). For this second Wildlife Action Plan nine bumble bee species and 31 species of butterflies and moths—including the Monarch butterfly—were selected as Species of Greatest Conservation Need.

Bad News & Good News

The preceding summary of threats is sobering to say the least. It challenges everyone concerned about wildlife and wildlife habitat to think smarter and work harder and more creatively. The good news here is that we can focus our limited conservation resources on the strategies that will provide the biggest bang for the buck, such as those outlined in this report that come up again and again including habitat restoration, encouraging wildlife-compatible resource use, providing education and technical assistance to landowners and managers, and providing economic incentives for conservation

But to do justice to this Action Plan, and to help the many SGCN and habitats in need, we need to add one problem to the list of major issues impacting Species of Greatest Conservation Need that our technical teams did not identify directly in their assessments, but it was often discussed during team meetings—the lack of sufficient funding for wildlife conservation. Without sufficient funding we will not be able to implement many of the conservation strategies identified in this report. The State Wildlife Grants program is a critical first step in funding SGCN conservation, but more is needed. And, to make the most of SWG funds, Vermont will have to develop the required matching stateside funds.

Conservation Success!

Keeping Common Species Common

Despite the changes to the Vermont landscape, the fact is, Vermont remains a relatively rural state with an abundance of conserved land, private landowners who are excellent stewards of the environment, and many wildlife conservation success stories. The public opinion survey results (U.S. Fish & Wildlife Service 2001) speak volumes for the bright future of wildlife conservation in Vermont—that is, the public has a strong interest in and support for the conservation of Vermont’s natural heritage.

Moreover, a review of past and ongoing wildlife conservation efforts provides proof of our collective ability to recover and conserve wildlife and the habitats required for their survival. It also identifies the key building blocks for successful conservation.

In 1724, when the first European settlement was established at Fort Dummer, near Brattleboro, the state was primarily forested and had abundant fish and wildlife populations including Passenger Pigeons, fisher, wolves, deer, black bear, beaver, and salmon. However, by 1865 many of these species would be present in far fewer numbers or on the cusp of extirpation because of unregulated harvests, habitat loss and habitat degradation.

Hunting and fishing license fees, soon after the turn of the 20th century, coupled with federal wildlife and sportfish restoration act dollars, enacted in the 1930’s and 1950’s respectively, established a financial framework in support of conservation. These monetary resources enabled Vermont, and the other states, to conduct inventories and research, acquire habitats, and provide conservation education to the public. Today, some of the species of low abundance 150 years ago are now once again common throughout the State. Consider, for example:

White-tailed Deer: Numbers were so low in the late 1800’s that no open season was offered and deer were transported from New York. Through extensive research, harvest management, and habitat protection, Vermont can now support more than 150,000 deer with 48 days of hunting opportunity, annually.

Wild Turkey: This bird was extirpated from the state in the 1800’s. Birds were reintroduced to the state in 1969. We now have more than 40,000 Turkey and both fall and spring hunting opportunities.

Fisher: This mid-sized carnivore was extirpated from the state. Animals were reintroduced to Vermont beginning in 1959 (to help control porcupine), and this predator now thrives on the Vermont landscape.

Anadromous fish on the Connecticut River: Migratory fish in the Connecticut River, including Atlantic Salmon, American Shad, Striped Bass and River Herring were reduced or eliminated in 1798 by a dam built in Turners Falls, Massachusetts. With the construction of fish passage at dams, and active restoration programs Shad, Stripers and Herring are now abundant in the lower river.

Trout and salmon in Lake Champlain: Landlocked Atlantic Salmon disappeared from Lake Champlain in the 1850's, and native Lake Trout were gone by 1929. A restoration program was begun in the 1970's in cooperation with the State of New York and the US Fish and Wildlife Service, and these fish are plentiful once again in Lake Champlain where they support a popular fishery that brings hundreds of millions of dollars into the regional economy each year.

Lake Sturgeon: A combination of dam construction, pollution and over-fishing reduced Lake Sturgeon populations in Lake Champlain in the early 1900's to the point that the commercial fishery was abandoned and all fishing for sturgeon was prohibited in 1967. Since this fishing closure Sturgeon conservation has benefited from water quality improvements, better water flows at the dams, and outreach to anglers to release any sturgeon they catch. Recent studies have documented successful natural reproduction of sturgeon in three of their historic spawning rivers in Vermont (Lamoille, Winooski and Missisquoi).

Peregrine Falcon, Osprey, and Common Loon: These birds were gone or nearly gone from the state by the mid-1900's, through focused management (e.g., the construction of artificial nesting platforms, water level management, banning use of the pesticide DDT and public education), each of these three species has recovered sufficiently that they've recently been removed from the state's endangered species list—a first for any species in Vermont.

Bald Eagle and Common Tern: Listed as endangered in Vermont, the known nesting population of Bald Eagles in Vermont has grown from zero in 2007 to 21 nesting pairs with 34 fledglings in 2016. Vermont's Common Tern population dropped from 300-400 breeding pairs in the 1980s to approximately 50 in 1988 when it was listed as endangered. With monitoring, management and the protection of nesting islands their numbers have increased since then. Breeding numbers have recently exceeded the levels recommended for down-listing to Threatened (but continuing low productivity delays down-listing).

These success stories suggest that new dollars coupled with patient and persistent efforts can produce new success stories for the future. In other words, the fish and wildlife profession has demonstrated the will and the competence to restore and manage wildlife. The Wildlife Action Plan, coupled with sustained funding and the dedicated participation of partners, will offer a template for advancing the success stories to a new suite of species.

The Importance of Education, Law Enforcement and Recreation to Wildlife Conservation

Through the State Wildlife Grants program (SWG) Congress provides every state with critically needed funds for wildlife conservation. Congress' intention is to support proactive and strategic efforts to prevent future Endangered Species Act listings—in other words, to keep common species common. To meet Congressional intent, states are compelled to employ all their best conservation tools including education, wildlife-associated recreation and the creation and enforcement of wildlife protection laws and regulations. These are among the most proactive, strategic and time-tested tools in any conservation tool box.

The details of the SWG program legislation, however, currently preclude states from using SWG funds for law enforcement and recreation projects. A limited amount of SWG funds can be used for conservation education, but only in a supporting role in the implementation of a conservation strategy (e.g., signage explaining the purpose of a restoration project). This poses a dilemma for states trying to implement a truly comprehensive wildlife action plan because it restricts their use of three vital conservation tools. Moreover, it limits the participation of three significant conservation constituencies from participating in Wildlife Action Plan implementation—the law enforcement, education and outdoor recreation communities.

A limited number of education and law enforcement conservation strategies specific to individual species or habitat categories were addressed in the species and habitat conservation summaries of this report (Appendices A and B). We recognize that alternative funding sources are needed for their implementation. In this section of the Wildlife Action Plan report we present additional conservation strategies based on conservation education, wildlife-associated recreation and law enforcement. It is our hope that future renderings of the State Wildlife Grants program, along with other funding mechanisms, will more fully provide for the implementation of these strategies.

Conservation Education

Wildlife and human communities depend on healthy ecosystems and ecological processes. Their functions are essential for our quality of life and for the Vermont economy. Conservation strategies that follow a sound education model can foster healthy public behavior and attitudes toward land and wildlife conservation. Furthermore, strong educational programs that expand Vermonters' ecological literacy will enhance the credibility and effectiveness of other conservation efforts and build support for future efforts. Finally, the public plays a key role in influencing legislators, who in turn affect policy and funding decisions. Recommended strategies include:

- Foster and enhance educational partnerships to maximize efficiency (e.g., develop volunteers, outreach to teachers and youth group leaders to deliver programs)
- Ensure that sound messages, curricula, and best educational practices are followed to maximize our efforts (e.g., provide teacher training, curriculum support materials for teachers and students.
- Define a land stewardship message that promotes the conservation and ethical use of Vermont's fish, wildlife, and plants, and the habitats that sustain them.
- Focus outreach and education efforts to enable the public to make informed decisions on issues affecting ecosystems in Vermont such as: habitat degradation and fragmentation, threats to fish

and wildlife species and their habitats, the value of working rural landscapes and other rural lands, and the sustainable and ethical utilization of wildlife.

The connection of education to wildlife conservation is recognized nationwide. The Association of Fish and Wildlife Agencies developed the [North American Conservation Education Strategy](#) in 2010 to help make improve conservation education programs nationwide.

Wildlife-Associated Recreation

Hunting, fishing, trapping, and wildlife viewing have a long heritage in Vermont and Vermont leads the nation in wildlife viewing (U.S. Department of the Interior et al. 2011). By providing the means for more people to connect with wildlife, we can foster more and stronger relationships to the natural world. Applying the concept of stewardship through recreation Vermonters can become knowledgeable about and appreciate wildlife, natural communities, and conservation in ways that promote citizen interest in contributing to conservation. Recommended strategies include:

- Work with the broader community of recreation groups (e.g., outdoor guides, birders, sportsmen and women, hikers, paddlers, climbers, spelunkers, mountain bikers and snowmobile and ATV associations) to foster partnerships that build a stronger wildlife ethic among members.
- Expand educational programs on watchable wildlife, including such topics as birding, wildlife photography, animal track identification, and backyard habitat. Target population centers, with a focus on youths and families.
- Increase information available to the public on how and where to watch wildlife. Provide information to encourage watchable wildlife practices, such as viewing, photographing, and feeding, in a manner that is ethical, safe, and consistent with protecting the welfare wildlife resources.
- Foster a recreational ethic based on the concept of giving back to the natural world.
- Include an educational component in recreation activities making the connection between our actions and the impact on wildlife.
- Involve Vermonters in activities that will increase their understanding of wildlife, land stewardship and the influences of human activities on wildlife, to build public support for fish and wildlife conservation (e.g., citizen science projects such as the bird atlas, butterfly survey and other wildlife inventories, teacher training courses, streambank plantings, and field classrooms).
- Encourage responsible outdoor recreation through programs such as "Stop Aquatic Hitchhikers," "Leave No Trace," "Stay on the Trails," and "Be Bear Aware."

Statewide Comprehensive Outdoor Recreation Plan: In addition to the Wildlife Action Plan, states develop comprehensive plans for outdoor recreation as a requirement for receiving support from the federal Land and Water Conservation Fund (LWCF). The [Statewide Comprehensive Outdoor Recreation Plan](#) (2014-2018) developed by the Vermont Forests, Parks & Recreation Department helps guide efforts provide high quality outdoor recreation facilities, opportunities and experiences for Vermonters and visitors.

Law Enforcement

The creation and enforcement of fish and wildlife laws are among our society's oldest attempts to conserve wildlife. Vermont's first game wardens were appointed in 1779 to protect deer and were called

“Deer Reeves.” Law enforcement is an effective conservation tool and has been at the core of wildlife conservation ever since.

State game wardens prevent the illegal taking, trade, sale, collection and importation of wildlife by proactive enforcement of fish and wildlife laws. Game wardens also prevent and investigate the unlawful destruction of important habitat, trespass and disturbance of refuge areas and sensitive breeding grounds and enforce the regulations and permits that govern wildlife research, education and rehabilitation.

Law enforcement professionals strive to be proactive: Game wardens are an integral part of the Fish & Wildlife Department's outreach and education programs. Wardens teach conservation at schools, civic organizations and conservation camps and are often the first, and sometimes only, contact that the public has with a conservation professional. Recommended strategies include:

- Maintain staffing of game wardens statewide sufficient to ensure the adherence of all laws pertaining to fish, wildlife and habitat conservation.
- Continue to conduct routine patrols, incidental to core duties, providing enforcement of boat, ATV and off road recreational vehicles to address the illegal operation and destruction of sensitive habitat and wildlife areas.
- Review, update, and enforce regulations controlling the importation and possession of exotic and potentially harmful fish and wildlife species and their pathogens.

Recent projects

As people interact more and more with wildlife, the number of wildlife-human conflicts increases. In 2014 Vermont game wardens responded to more than 500 calls from the public on issues such as rabies and damage to property. If not adequately addressed, members of the public might try to resolve the issues themselves in a manner unduly detrimental to wildlife. Many encounters require a physical response by a warden to prevent human injuries or disease exposure.

All for one and one for all: Law enforcement, Education & Recreation

It should be clear to a reader by this point that not only is each of these three tools critical to the long-term conservation of wildlife, but that they are all tightly intertwined. For example, our best opportunities to instill the message of conservation in the public are when they are out in nature recreating. And, state game wardens are often the ones to deliver the message. Furthermore, outdoor guides and other recreationalists often provide tips to wardens and compliance officers regarding habitat degradation or the illegal taking of wildlife, and by doing so they send a strong message to the public that Vermonters care about wildlife.

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