

Vermont's Wildlife Action Plan

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**formally the Comprehensive Wildlife Conservation Strategy (CWCS)*

2. 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 2001 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 (60%). The results also show that hunting, fishing, and wildlife viewing expenditures in Vermont totaled \$386 million, an increase of \$6.42 million over the previous 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 each year. These statistics represent a significant contribution to the state’s economy and underscore the strong connection Vermont residents and non-residents have to the land and wildlife.

Vermont’s diverse natural 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, 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 rises 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 the shores of Lake Champlain, where the growing season is 150 days, shagbark hickories and sweet gum 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 the affect of climate on biota can easily be observed.

Geology

Vermont's bedrock composition is varied and thus, influences important factors such as soils, hydrology, and subsequently plant

distribution and abundance. These variations influence in part the distribution of wildlife. The rocks that comprise 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.

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 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 are found.

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.

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 unique habitat for specialized groups of plants, and may offer important 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

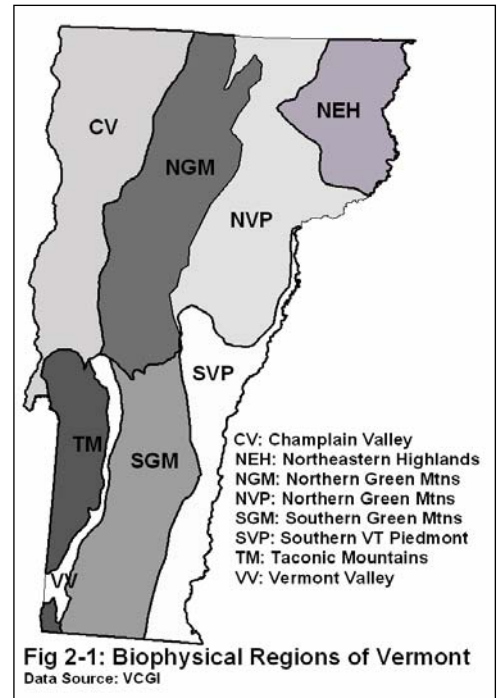
Water and its movement have a profound influence on animals, plants and natural communities, and ecosystem processes. Lakes, ponds, rivers, and streams provide habitat for a diversity of fish, aquatic plants, aquatic invertebrates, and other organisms. Wetlands form in waterlogged soils, either in low-lands 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 (78%) 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 eight 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, Fend 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 cold 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 side slopes, whereas high elevations have spruce and fir as well as Alpine meadow habitat. 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 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 had an effect on the state's waters, forests, and wildlife. Even some species of wildlife 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, deer, wild turkey, fisher, and others that had declined have now returned and are today abundant. These species and more 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) 11,000 landowners have brought almost 1.5 million acres of forestland under forest management. 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, Inc., Vermont Woodlands Association, and the Woodland Owners Association. These stewards provide strong examples of Vermonters taking steps to conserve our wildlife resources.

The landscape of Vermont is also supporting increasing demand for residential and commercial development. The Vermont Forum on Sprawl reports that the rate of development in Vermont is 2.5 times greater than the rate of population growth. Like other New England states, residential development is often dispersed in rural and suburban areas rather than in existing village and urban communities.

Based on data from the U.S. Census Bureau, the population of Vermont in 2004 is 621,394 and has increased by 2.1% since 2000. The human population of Vermont is quite small compared to many other states.

Since 1964, Vermont has lost roughly one-third of its farms and half of its farming acreage (Pers. Comm. Vermont Dept of Agriculture 2005). Today, Vermont loses approximately 100 farms each year.

Parcelization is a term that describes the subdivision of land into smaller and smaller pieces and multiple ownerships. This phenomenon has been shown to have an impact on the ability of local forest product economies to remain sustainable. Parcelization is occurring in parts of Vermont where larger tracts of land are

subdivided into smaller multiple smaller parcels for residential development. This may have some influence on Vermont's forest products interests in the future and at the very least is something that should be considered with respect to maintaining viable forest products economies for all the positive benefits that they provide to the state and its wildlife.

Contemporary Problems Impacting Wildlife in Vermont

An extraordinary amount of work went into developing this report. Our technical teams assessed the status all of Vermont's birds (268), fish (94), mammals (61), reptiles and amphibians (42) and many group of invertebrates ranging from mussels, to beetles, to butterflies and isopods. From there Species of Greatest Conservation Need (SGCN) were selected and the technical teams then described the habitat these species used, problems impacting the species and their habitats, and strategies to conserve both species and habitats. Add to this assessments and recommendation for 25 major landscapes and community types and it's not surprising that this report tops the 1,000-page mark.

The interesting thing is this: if you take two steps back from the details to view the big picture, the view is not a grim one. Yes there are more than 300 SGCN but the picture we see is a hopeful one, a roadmap to healthy wildlife populations for Vermont's future. The reasons are repetition, economies of scale, and cooperation.

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 trails, pollution and sedimentation, invasive species, climate change, and data gaps and information needs. Though these are big, serious and complicated problems they are much easier to address than hundreds of smaller problems.

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 particular 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 525 acres of significant 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. Significant habitats are those habitats that are 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 as a result 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.

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 which depends on a mix of forest stages).

Impacts of Roads and Trails

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. 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 (1999). Transportation systems, including some hiking and recreation trails, 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.

Pollution & Sedimentation

The introduction of exotic materials from point and non-point sources can significantly impact SGCN, particularly aquatic species. Pollutants & 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.

Invasive Exotic Species

The introduction and spread of nuisance 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 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 and zebra mussels. Additional information can be found in Appendix K.

Climate Change

Long-term changes linked to global warming and other climate issues can lead to 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 is a major unknown, but the pervasiveness and scale of the problem requires that we begin planning to address it now.

Data Gaps and Information Needs

A lack of information has been identified as a principal impediment to the conservation of many Species of Greatest Conservation Need. In particular we need additional information on the distribution and abundance of SGCN and the status of local and statewide populations, a better understanding of habitat needs, life-history information, and information related to SGCN movement and migration. This information will help to fine-tune strategies and guide management for SGCN.

The Silver Lining

We noted at the beginning of this section that recurring problems actually give us hope that we can conserve Vermont's Species of Greatest Conservation Need because if we address a problem for one species we're likely to do the same for many others. Similarly, several conservation strategies outlined in this report including habitat restoration, encouraging wildlife-compatible resource use, providing education and technical assistance to landowner and managers and providing economic incentives for conservation come up again and again in this report. 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.

Therefore to the list of major issues impacting Species of Greatest Conservation Need we'll add one problem that our technical teams did not identify directly in their assessments but that 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

In spite of 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 dedication 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 transplanted from New York. Through extensive research, harvest management, and habitat

protection, Vermont can now support in excess of 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, 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, and annual runs of Atlantic salmon have been restored to the lower river after a nearly two hundred year absence.

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 all four of their historic spawning rivers in Vermont.

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, 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.

These success stories suggest that new dollars will 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 Wildlife-Associated 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 of 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 particular 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 provide for the implementation of these strategies and other others in their realms.

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, the sustainable and ethical utilization of wildlife.

The connection between education to wildlife conservation is recognized nationwide. The International Association of Fish and Wildlife Agencies (IAFWA) is sponsoring the development of a national strategic plan for conservation education, the resulting plan will make conservation education a top priority for state fish and wildlife agencies (Case 2005).

Wildlife-Associated Recreation

Hunting, fishing, trapping, and wildlife viewing have a long heritage in Vermont and Vermont leads the nation in wildlife viewing (US DOI 2001). 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 and land stewardship and the influences of human activities on wildlife, in order 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."

Recent projects

A joint VFWD-Vermont Federation of Sportsmen's Club project in 2003 is a good example of a wildlife-based recreation project. Using funds from the short-lived Wildlife Conservation and Restoration Program (WCRP), a predecessor to the State Wildlife Grants program, public access to the Blueberry Hill Wildlife Management Area was enhanced.

The Fish & Wildlife Department recently developed and helped implement a combined physical education/ conservation curriculum for Vermont schools.

Statewide Comprehensive Outdoor Recreation Plan (SCORP): In addition to the Wildlife Action Plan, states are developing comprehensive plans for outdoor recreation as a requirement for receiving support from the Land and Water Conservation Fund (LWCF). The National Parks Service in the U.S. Department of the Interior administers the LWCF. The National Parks Service's term for this planning process is known as the SCORP, which stands for Statewide Comprehensive Outdoor Recreation Plan. The Department of Forests, Parks & Recreation (FPR) is leading the development of Vermont's SCORP. The document will be ready in 2005

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 critical 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 general public has with a conservation professional. Recommended strategies include:

- Maintain staffing of game wardens and compliance officials statewide sufficient to ensure the adherence of all laws pertaining to fish, wildlife and habitat conservation. State game wardens conduct routine patrols 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 2002 Vermont game wardens responded to more than 1,000 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. Funds from the short-lived Wildlife Conservation and Restoration Program (WCRP), a predecessor to the State Wildlife Grants program, helped enhance VFWD's wildlife-human conflict management efforts through additional equipment, outreach materials and staff training. These enhancements improved responsiveness and effectiveness in addressing these real and growing needs.

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 general public that Vermonters care about wildlife.

Vermont Department of Forests, Parks & Recreation: Current Efforts Related Wildlife Conservation

The mission of the Department of Forests, Parks & Recreation is to practice and encourage high quality stewardship of Vermont's environment by:

- *monitoring and maintaining the health, integrity, and diversity of important species, natural communities, and ecological processes;*
- *managing forests for sustainable use;*
- *providing and promoting opportunities for compatible outdoor recreation; and*
- *furnishing related information, education, and service.*

To fulfill our mission, the Department will continue to work, as we have for almost a century, for sound management and sustainable use of Vermont's forests, forest land, other natural resources, and outdoor recreation opportunities.

The Vermont Department of Forests, Parks and Recreation pleased to have had the opportunity to be involved in Vermont's first Wildlife Action Plan. As the proposed conservation strategies are implemented, this plan could have a significant impact on the management of public and private forest lands within the state.

Without healthy, sustainable forests in Vermont, attempts to conserve wildlife would be in vain. The animals and the habitat are inextricably linked... Forests should continue to dominate our state's landscape to ensure healthy wildlife populations.

The vast majority of Vermont's forests are privately owned and unless landowners can expect a reasonable return from their forest resources, maintaining land as part of a working landscape may be difficult. Equitable taxation (through programs like the Use Value Appraisal Program) and strong local markets for forest products are critical to ensure the conservation of forested habitats by this largest portion of landowners. The Department's efforts (in this respect) can be broadly categorized into program management, state lands management, information and education, forest protection and economic development.

With respect to programs which most directly effect wildlife resources, our activities include:

State Land Management: Manage in a sustainable manner state-owned land for the purpose for which it was acquired and the wishes of the public, and in cooperation with the Fish & Wildlife Department and Department of Environmental Conservation. This amounts to 348,000 acres (1999). Primary goals include protecting land and water, maintaining ecosystem integrity, maintaining or enhancing biodiversity, protecting historic and cultural sites, providing compatible recreation opportunities, and producing wood products. In accordance with long-range management plans we additionally, construct and maintain high-quality forest roads for management activities, developed parks and recreational sites, and controlled recreational access for public uses. The Department also manages and/or monitors conservation easements on over 42,000 acres (1999) of private land. Both state-owned land and easements include those purchased with assistance from the Vermont Housing and Conservation Trust Fund, federal Land and Water Conservation Fund, the Forest Legacy Program, and State Trails Fund to ensure they are maintained for the public values for which they were acquired.

The Forest Legacy Program (FLP) is a federal grant program to protect forestlands from conversion to non-forest uses. The Vermont Department of Forests, Parks & Recreation is State Lead Agency for Vermont's Forest Legacy Program. The program is entirely voluntary. Landowners who wish to participate may either sell the property as fee simple title (all rights), or only a portion of the property rights and retain ownership of the land. The use of conservation easements allows the land to remain in private ownership and ensures that important public values such as wildlife habitat, natural areas, forest resources, and outdoor recreation opportunities are protected.

Use Value Appraisal (Current Use Program): Administration of the forestry portion of the use value appraisal (current use) tax program on the million + acres (1999) of actively managed, private forest land enrolled. This includes providing public information, approving management plans, and inspecting parcels to insure compliance with standards and the management plan.

Private Land Management -- Technical Assistance: Provide information and technical assistance to private landowners on how to manage their land properly. This includes helping landowners understand and evaluate the timber, wildlife, ecological, historical, and aesthetic values of their woodlands. Advising landowners on the availability of private consulting services to help them carry out their management objectives.

Acceptable Management Practices (AMPs): Provide information and materials, and monitor practices that maintain water quality -- minimizing erosion, sedimentation, and temperature changes -- on logging jobs. Assist loggers and landowners to implement AMPs. Respond to citizen complaints. Assist in fact-finding and prosecution of violations. Provide education directly and through partnerships.

Acquisition of Land/Interests in Land: Continue to provide adequate state land for conservation, outdoor recreation, timber production, and other purposes consistent with a statewide policy and plan (the Agency's Lands Conservation Plan, effective July 1999). This includes exchanges, fee-simple acquisitions, acquisitions of interests in land, and identification/disposal of surplus lands.

Forest Land Conservation: Following up the recommendations of the Vermont Forest Resources Advisory Council (FRAC) and Northern Forest Lands Council (NFLC) continue to explore ways to:

- Enhance local rural-based economies through public policies that encourage, rather than discourage, investment in forest-dependent businesses.
- Conserve tracts of undeveloped forest land.
- Explore continually-evolving issues about Vermont's forest land.

Natural Areas Designation/Protection: Continue to identify, designate, and protect areas of significant biodiversity and/or geologic interest on state land. Presently 33 areas are designated.

Forest Health Monitoring: Assess, monitor, and report on the health of Vermont's forest resources by periodic measurements of tree condition and other ecosystem parameters (e.g., soil chemistry and structure, indicator plants and animals, vegetation structure), following national, regional, and state protocols. This includes Vermont Hardwood Health Survey, North American Maple Project, National Forest Health Monitoring Program, and Forest Inventory and Assessment (FIA).

Forest Insect and Disease Management: Protect Vermont's timber, sugarbush, urban forest, Christmas tree, and non-commercial forest resources from significant loss of ecological, economic, or aesthetic value due to damage by forest insects, disease pests, or other biotic and abiotic stressors. Assess role of natural insect and disease outbreaks in overall ecosystem integrity. The Department provides information, data, and technical assistance to landowners, managers, and state and federal agencies. We also implement procedures for handling insect and disease outbreaks and assist in research conducted by other organizations.

Vermont Forest Ecosystem Monitoring (VForEM): Participate as a major partner in VForEM to: Provide information needed to understand, protect, and manage forested ecosystems within a changing global environment. Promote understanding of the conditions, trends, and relationships in the physical, chemical, and biological components of forested ecosystems in Vermont. Promote efficient coordination of multi-disciplinary environmental monitoring and research among federal, state, and private entities.

Conservation Education: Continue and improve interpretive education programs and materials for individuals, schools, groups, and state park visitors, on natural resources, their management, and other related topics. This includes the summer park naturalist program; fall park naturalist program for Vermont students; Project Learning Tree coordination; production of needed written, audio, photographic, and video materials; providing information via the Internet; networking with other educational institutions, organizations, and programs on special projects; and filling requests for natural resources career information. Continue work on alignment of curriculum materials (PLT) with "Vermont Framework of Standards and Learning Opportunities." Continue work with Vermont Institute for Science, Math, and Technology (VISMITE) and Department of Education on natural resources education. Provide information on state land.

Informal and Formal Education: Continue strong commitment throughout the Department, in all activities, on education in our informal contacts with the public, presentations, workshops and demonstrations in the field, school visits, activities on state lands, and other means. This includes continuing education and training for loggers, foresters, and others resource workers. Produce and provide printed materials and public use maps; fill requests for alternative formats. Work with the Department of Education on natural resources management education as a requirement in school curricula, including such topics as wildlife, forestry, water resources, recreation, etc.

Research and Monitoring: Participate in a variety of research and monitoring projects (often with cooperators, such as the University of Vermont and U.S. Forest Service) on important natural resources issues, such as forest health, recreational use of lakes, economic contributions of forest-based businesses, and forest practices. Make the data and information available and useful to the public and special interests.

Vermont Department of Environmental Conservation

The concept that healthy wildlife populations support healthier natural systems upon which we all depend goes to the heart of our mission at the Department of Environmental Conservation (DEC). As such, DEC has been pleased to participate in the development of the Wildlife Action Plan.

The DEC is one of three departments in the Agency of Natural Resources. The Department's activities include: monitoring and ecological assessment, education, grants and regulatory oversight of the quality of air, surface water, drinking water, and groundwater, wetland and surface water ecosystems; and waste management and disposal. Department vision and mission statements describe 1) the future condition that the Department collectively wishes for Vermont and the balance that the Department seeks between Vermonters and the resources that the Department manages and 2) what the Department is working to accomplish respectively.

DEC Vision

"We envision a Vermont where people live in harmony with diverse and healthy natural systems; appreciate and enjoy our natural resources; understand the environment; work together responsibly to reduce waste and risks to human health and the environment; and prosper without significant degradation of natural systems. We envision a Vermont where people breathe clean air, drink clean water; eat safe food; and live in a sustained and healthy environment."

DEC Mission

"To preserve, enhance, restore, and conserve Vermont's natural resources, and protect human health, for the benefit of this and future generations."

The Department's work is organized into six programs: Air, Drinking Water, Surface Water, Waste, Groundwater and Earth Resources, and Management. Each of the Department's programs has identified goals developed strategies for achieving those goals. Goals and strategies that address wildlife conservation include:

Air: Goals of the Air program include *"to maintain a level of air quality in Vermont that supports a healthy, diverse ecosystem."* Strategies to achieve this goal include: maintaining base compliance, permitting, monitoring, and outreach and education programs; install air pollution control devices on regional air pollution generators having a discernable impact on Vermont; develop action plans for reducing chemicals which exceed Hazardous Ambient Air Quality standards.

Surface water: Goals of the Surface Water program include *"to maintain and enhance a level of surface water quality, quantity and stream morphology that supports the integrity of healthy ecosystems."* Strategies to achieve this goal include: maintain basic compliance, permitting, planning, monitoring, outreach, and education activities; reduce phosphorus loading to Lake Champlain through point and non-point source controls and improve municipal policies and bylaws; develop, with extensive education and public participation, watershed management plans for all major and minor watersheds that will outline strategic actions to monitor, restore, maintain and enhance the quality of waters within

each basin; provide education and technical assistance to enable communities, local organizations, and individuals to understand and minimize their impact on the watershed environment; develop assistance programs to enhance the management of dams, including removal when appropriate; develop and maintain a morphologically based stream restoration approach to river management; restore river reaches and lakes that are altered by artificial flow and water level management.

Groundwater and Earth Resources: Goals of the Groundwater and Earth Resources Program include *“to conserve Vermont’s earth resources.”* Strategies to achieve this goal include: maintain basic compliance, permitting, planning, monitoring, mapping, outreach, and education activities; complete investigation and remediation of contaminated sites; produce maps of all known sources and locations of contaminated groundwater.

Waste: Goals of the Waste program include *“to reduce hazardous and solid waste generation through pollution prevention, source reduction, reuse and recycling, to ensure safe management of solid and hazardous wastes that are generated, and to mitigate health and environmental impacts of improper waste disposal actions and accidental releases.”* Strategies to achieve this goal include: maintain basic compliance, permitting, planning, monitoring, outreach, and education activities; provide waste prevention information, assistance and recognition; provide solid and hazardous waste facilities management and oversight; provide emergency spill response and management of contaminated sites.

The above provides a summary of Department of Environmental Conservation goals and strategies related to environmental conservation, many of which directly and indirectly benefit wildlife. Strategies include many long-established ongoing activities, including technical assistance, monitoring, grants, and regulatory services. Each program works in partnerships with citizen groups, municipalities, businesses and other government agencies including the Vermont Fish & Wildlife Dept and the US Fish & Wildlife Service. These coordinated efforts are critical to the success of making progress towards each of the program’s goals. A few of those activities are described below.

Biodiversity monitoring is an ongoing activity conducted by DEC biologists. Monitoring activities are conducted to evaluate the status of selected biological species and communities. Specific activities include: 1) distributional surveys of plant and animal species listed by the Vermont Endangered Species Committee as endangered, threatened, rare, or of special concern; and 2) monitoring of biological communities or community types whose diversity is threatened (e.g., Lake Champlain mussel and cobble/shale invertebrate communities threatened by zebra mussels). Data are used to: 1) describe species distributions; 2) identify species/communities at risk; and 3) develop management plans for the protection of identified species/communities (e.g., Lake Bomoseen bladderwort relocation).

DEC biologists, in collaboration with other state and federal agencies, have been involved in a variety of activities related to the ecology of wetlands. These activities include: investigations onto the occurrence and potential causes of malformations among Northern leopard frogs in Vermont; a study of the biological communities of vernal pools; demonstrations of the use of herbivorous insects for the control of invasive exotic plant species in lakes and wetlands

The Department is increasingly using watersheds as the basis for water quality protection and management, and to determine assessment and monitoring priorities. Through the Department's educational efforts, watersheds are now the focus as people learn about their individual role in causing and controlling pollution, protecting water resources, and in preserving the land. The Department, following the "Guidelines for Watershed Planning," is conducting seven Basin Planning Processes that includes working with local land owners and other residents to restore impaired waters and formulate strategies to restore and protect waters throughout the watersheds. As part of this effort, bioassessment and biomonitoring will increasingly guide water quality management.

For more information about DEC programs and projects go to:
<http://www.anr.state.vt.us/dec/dec.htm>

Why is the Vermont Agency of Transportation Concerned about Fisheries and Wildlife Issues?

The Vermont Agency of Transportation (VTrans) has a productive working relationship with the Vermont Fish and Wildlife Department, and numerous activities related to fisheries and wildlife described in the following pages. There are several important reasons for this work.

1. **Safety:** Wildlife on Vermont's highways represents a significant risk to humans. Numerous lives are lost and there are billions of dollars in property damage every year nationally due to vehicle-animal collisions.
2. **Fiscal Benefits:** There are potential fiscal benefits to the state and the agency by reducing wildlife collisions and better planning for wildlife and fisheries impacts from transportation including:
 - Reduced insurance claims.
 - Increased hunting and fishing license revenues from healthier and more numerous deer and moose herds and a healthy indigenous fishery.
 - Improved planning lessens the potential for regulatory battles and thus reduces transportation project costs.
 - Reduced bridge and culvert maintenance costs. Bridges and culverts that provide fish passage are subject to fewer impacts from sediment and debris transport and erosion.
3. **Stewardship:** Protection of wildlife and improved fisheries are important issues for Vermonters. Transportation has been shown to have negative effects to fisheries and wildlife including: increased animal mortality from vehicle collisions; direct and indirect effects to habitat from the existing transportation system, increased traffic, and proposed improvements including new and expanded roadways; reducing animal and fish passage, thus limiting habitat availability and isolating populations; and the effects of pollutants from vehicles such as ozone and green house gases on the state's ecological health. VTrans needs to be a good environmental steward and respond to the public's concerns about fish and wildlife protection.

Stewardship means better working relationships with regulatory agencies—improved trust, communication, coordination and collaboration - which all help to avoid confrontation in the regulatory process.

4. **Wise Allocation of Resources:** Hundreds of state bridges and culverts are insufficient regarding fish passage. Federal and state dollars to repair, retrofit, and replace these structures are severely limited. Planning and cooperation with the Vermont Department of Fish and Wildlife is needed to make investments that will have the most benefit to all indigenous aquatic organisms.

5. Prudence in the Regulatory Process:

- Working with Fish and Wildlife biologists to better plan, predict problems, and evaluate resources in advance of project design prevents conflicts regarding specific species and habitats during regulatory processes.
- Planning for mitigation at the watershed or bioregion level, rather than mitigating transportation impacts on a case by case basis has the potential to reduce mitigation costs and have greater wildlife benefits.
- Transportation agency knowledge and involvement in wildlife and fisheries planning means that indirect and cumulative impacts (under the National Environmental Policy Act NEPA) are better coordinated and more easily addressed for large projects.

The National Perspective

Road ecology - the notion of accommodating wildlife and fisheries movement around and through the transportation system and minimizing habitat fragmentation - is being considered nationally through the Federal Highway Administration (FHWA) and at increasing numbers of state DOTs.

States are employing a mix of underpasses, bridge extensions, culvert installations and modifications and associated fencing and ecowalls to facilitate and guide wildlife movement. Research is also underway through the auspices of the National Cooperative Highway Research Program to investigate how to identify the best wildlife crossing alternative for a site, design guidance and standards, maintenance costs, and a tool to determine cost effectiveness.

Several states, including Vermont, a leader in the Northeast, have also been conducting research and setting policy regarding practice and design guidance for culvert installation, design and prioritization for fish passage.

Transportation planners and highway engineers, biologists, state and federal environmental regulators, and environmental interest groups have been sharing information and research for several years within the context of the biannual International Conference on Ecology and Transportation (ICOET). This first gathering of experts supported in part by the FHWA occurred in 2003 at Lake Placid, New York. The theme for the 2005 conference, which will be held later this year, is "*On the Road to Stewardship*." The conference website (www.icoet.net/ICOET2005.html) explains that:

The 2005 "Stewardship" theme is designed to encourage conference presenters and participants to share information about projects and best practices that show how they are moving beyond regulatory requirements in order to respond to broader scientific and community-driven concerns related to the consideration of ecological concerns in transportation planning, project development, construction, operations and maintenance.

History in Vermont and Initiatives Underway

For the past several years, the Vermont Agency of Transportation has had several important initiatives related to road ecology. This work is a collaborative partnership with the Vermont

Fish and Wildlife Department and includes a Wildlife Crossing Steering Committee, chaired by VTrans' Director of Program Development. Initiatives include:

- The effects of new transportation projects on habitat and consideration of animal and fisheries passage are considered early in the project planning process. These effects are also considered in the maintenance and upgrading of the existing transportation infrastructure. One recent and very successful example of the former is agreement reached among the regulatory agencies regarding a major expansion of Route 78 through the Missisquoi National Wildlife refuge.
- The first-ever northeast regional wildlife and transportation conference held in 2004, a follow-up to the 2003 ICOET conference, and designed to forge a regional strategy regarding transportation and wildlife issues.
- VTrans and other partners on the Aquatic Organisms Steering Committee including the Vermont Fish & Wildlife and US Forest Service assessed the condition of over 200 large culverts (greater than 6' in diameter) in the Upper White River Watershed. The survey revealed that about one half of the existing large culverts under the state and interstate systems never pass fish. The remaining culverts only pass fish some of the time, and all of the structures suffered from structural damage and nearby stream degradation. Additional survey work in the Connecticut River Watershed during 2005 will help set future Agency culvert retrofit and replacement policy and priorities.
- A statewide GIS habitat database for use as a predictive model for making transportation decisions related to habitat connectivity. The database utilizes data collected by VTrans Operations and Maintenance road crews as well as data from the Vermont Fish and Wildlife Department.
- An inter-agency agreement that will create habitat for the eastern racer, a snake thought to have been extirpated from the state for at least 25 years that was recently discovered on VTrans property.
- Researchers from the University of Massachusetts Amherst have been retained to conduct a ground-breaking study on the efficacy of wildlife crossing structures being installed on the Bennington Bypass.
- VTrans and VDFW staff continue to monitor existing Interstate structures to identify potential crossing structures that are already part of the transportation system.
- Finally, VTrans staff continue their involvement in a habitat training program (recognized by AASHTO in 2003 with a National Environmental Stewardship Award nomination) that gets diverse personnel in to the field with wildlife experts from Keeping Track, Inc, the Vermont Herp Atlas, VFWD and others to learn how their work as transportation professionals can reduce impacts and reconnect habitat.

The Future

The Vermont Agency of Transportation's environmental policy adopted in 2004 recognizes the need for the agency to be proactive regarding its environmental stewardship responsibilities. The effects of the transportation system on Vermont's fisheries and wildlife are noted above. VTTrans' approach in the past has included research, dialogue and partnerships with the Department of Fish and Wildlife and other interests. This work will continue in 2005 including:

- Norwich University students performing both pre-construction and post-construction aquatic studies during the summer of 2005—upstream, downstream, and within large culverts on the Agency's critical list.
- A culvert design workshop planned for July 11-15, 2005 for ANR and VTTrans personnel with the goal of developing a set of design criteria that address hydraulics, debris and sediment transport, and the passage of all indigenous aquatic organisms.

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