State Forest Resource Assessment

Introduction

The primary objective of the State Forest Resource Assessment is to evaluate current forest conditions and identify priority forest areas and forest related issues for the purpose of focusing state and federal resources. State assessments and resource strategies are elements of State Forest Resources Plans required by the 2008 Farm Bill.

Federal guidance required that assessments be conducted using Geographic Information System (GIS) technology. Vermont relied on numerous sources to gather information spatially and worked with partners both within and outside the state who supplied spatial data used in the Assessment. The Appendix contains a complete package of all the maps referred to in the Assessment.

Desired Future Condition 1: *Biological Diversity*

Conserve biological diversity across all landscapes

Biological diversity encompasses the staggering "complexity of all life at all its levels of organization, from genetic variability within species, to species interactions, to the organization of species in larger landscape units" (Thompson, et al., 2000). Biodiversity is critical for the sustainability of Vermont's forests because it enables ecosystems to respond to external influences, to recover from disturbances and to support important ecological processes. All components of a given ecosystem are tied together in an intricate web, and alterations can have dramatic impacts on the entire system.

Ecological Mapping

Various levels of ecological mapping have been developed in Vermont to help identify areas with similar features. These maps are valuable planning tools to assist in managing Vermont's landscape.

Biophysical regions are large-scale ecological areas of similar climate, geology and vegetation, and human history, generally in units not smaller than 200,000 acres. Eight biophysical regions were identified in Vermont, five of which extend into neighboring states and the Province of Quebec, (Map 4: Biophysical Regions).

***Land Type Associations (*LTA)** are mapped in units between 500 and 10,000 acres. The boundaries are determined by elevation, soils and temperature. The LTA's in Vermont sort out into three broad categories: valley bottoms, mid-mountain slopes and mountain tops, (Map 5: Land Type Associations).

Natural communities are mapped at a small scale ranging from less than an acre in size (vernal pool) to over a thousand acres (northern hardwood matrix forest). In 2000, work in describing Vermont's natural communities was completed and resulted in the publication of *Wetland, Woodland, Wildland - A Guide to the Natural Communities of Vermont*. Natural communities are ranked as to their scarcity and sensitivity and this information is valuable in determining Vermont's priority landscapes in the Assessment. Natural communities are mapped on public land as part of the long-range management process. Certain natural communities of statewide significance are also mapped by consulting foresters for enrollment in Vermont's Use Value Appraisal (UVA) program. An example of state lands mapping of natural communities can be seen on the Groton

State Natural Communities Map:
www.vtfpr.org/lands/groton/2008NaturalCommunities.pdf

Forested Land Area

The area covered by forest in Vermont is shown in Figure 1, covering the time period from 1948 through 2008 (USDA Forest Service Forest Inventory and Analysis, Northern Research Station, 2008). The two categories of measurement used are from the US Forest Service, Forest Inventory and Analysis (FIA) data. The first category, "Forest land," either currently has tree cover or used to have tree cover and is expected to see that cover restored. This category includes otherwise productive forest areas, including wilderness designation, urban forests and natural areas that are not available for harvest. The second category, "Timberland," is productive forest land that is available for harvest. Understandably, the forest land acreage is higher than the timberland figures. Forested acres have been increasing over the second half of the 1900's, (Map 6: Percent Forested and Map 7: Forest Cover Types). It should be noted that timberland acreage can be unavailable for actual timber harvesting due to landowner objectives, topographical constraints and accessibility.

Since the 1997 forest inventory, the trend of increased forested acreage has flattened out and decreased slightly. Any additional acres of forest land are usually attributed to the abandonment of agricultural land. Those acres can have high ecological value as they are often in places where forests are important for wildlife corridors, serve as important portions of watersheds and riparian zones, and align with the Urban Landscape Zone. Forest inventory data also fails to capture all the urban forest resources that do not meet stocking levels, but these trees, riparian corridors and small forest patches contribute to the ecological, social and economic sustainability of Vermont's communities. Statewide, urban land in Vermont has an estimated 5.5 million trees and a tree canopy cover of 38% (Nowak, et al., 2008).

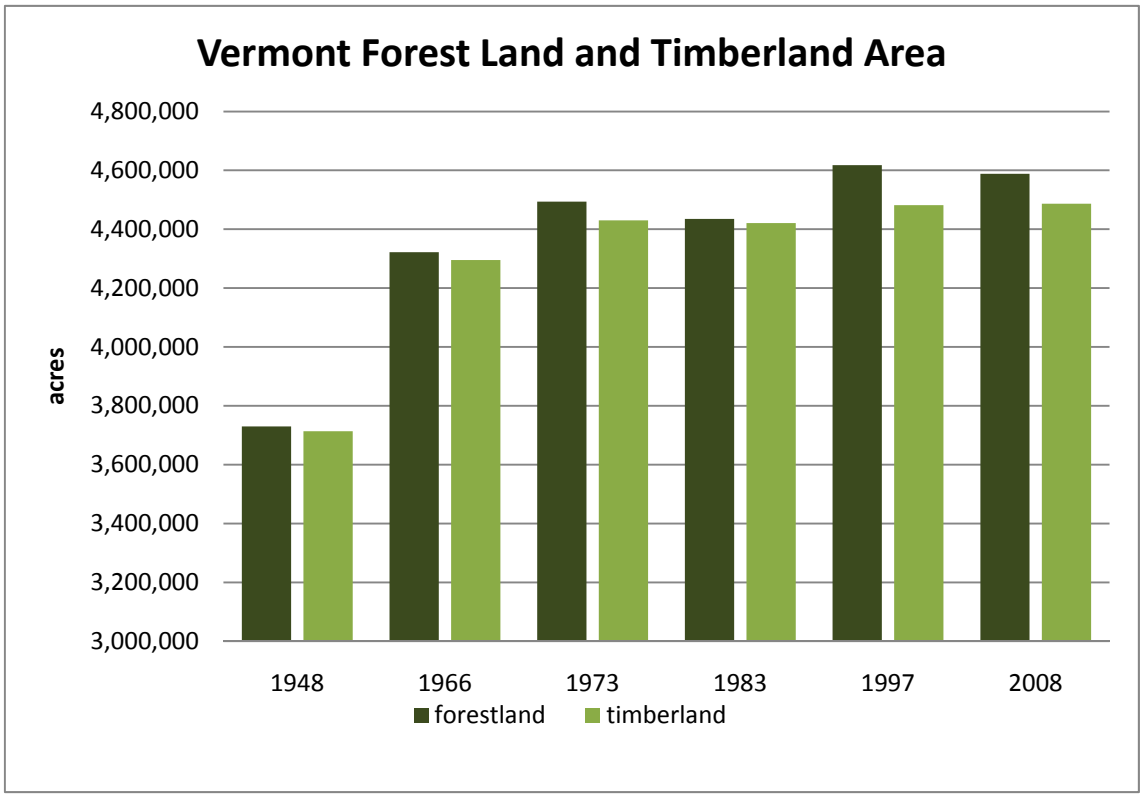

Figure 1: Vermont Forest Land and Timberland. *Source:* National Forest Inventory and Analysis Database, 2008

Species Composition and Distribution

The distribution of tree species in Vermont was obtained from FIA, (Map 8: Distributions of Vermont Tree Species), (National Forest Inventory and Analysis Database, 2008). This information is modeled from the 1996 inventory and shows the relative importance of 12 tree species in Vermont.

The following two charts (Figure 2 and Figure 3) show species composition as percent of total trees for softwoods and hardwoods, respectively. All softwood species show an overall decrease in percent of total trees between 1983 and 2008 except for fir. The decrease in hemlock, cedar, white pine and spruce was less than 2%. Balsam fir increased 1% between 1983 and 2008.

For hardwoods, the relative proportion of sugar maple decreased in both periods (1983-1997 and 1997-2008) from 19% to 16%. The proportion of beech increased from 11% to 16%. Changes in other species have ranged from 1-2%.

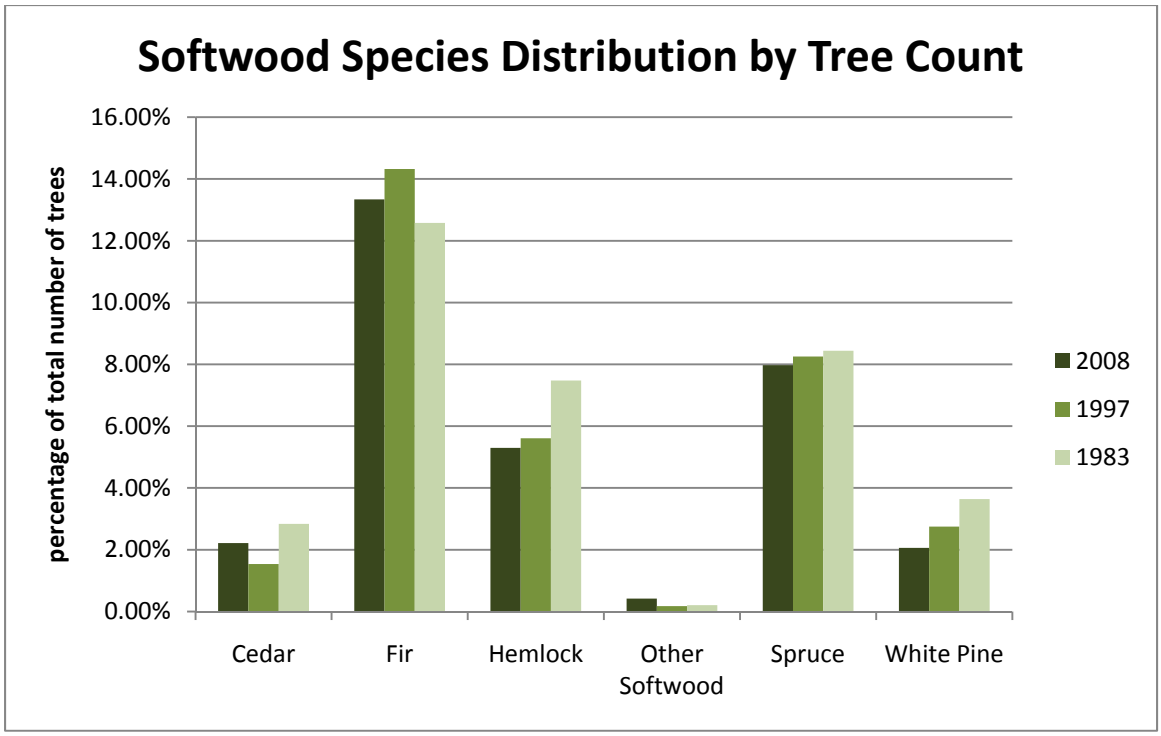

Figure 2: Softwood Species Distribution by Tree Count. *Source:* National Forest Inventory and Analysis Database, 2008

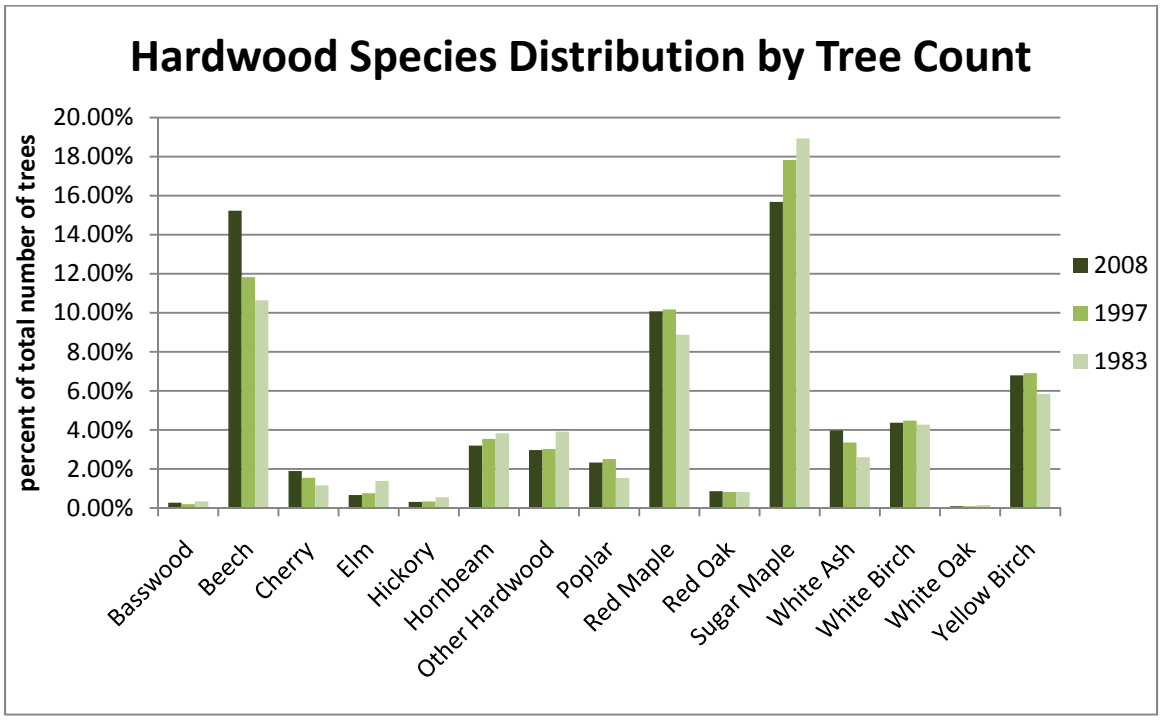

Figure 3: Hardwood Species Distribution by Tree Count. *Source:* National Forest Inventory and Analysis Database, 2008

In the past, changes in tree species composition were monitored to keep track of the relative proportions of selected commercially preferred and less preferred species. Sugar and red maple are examples of the former and latter. It is now recognized that biodiversity is a major component in maintaining healthy, resilient forests and is connected to forest sustainability, wildlife habitat quality and forest health. In the coming years, it will become more important to monitor overall species composition to detect forest changes due to climate change and other disturbances. In order for this monitoring to be useful, better techniques for interpreting the existing data will be needed.

Habitats

The abundance of forested land in Vermont provides a wide variety of habitat for wildlife. In 2001, the US Congress required each state to produce a Wildlife Action Plan to help direct federal funding and, in 2005, Vermont's Wildlife Action Plan was completed. In Vermont, the emphasis is on a statewide, science based all-species conservation strategy. Detailed species assessment reports were prepared for 144 vertebrates and 191 invertebrates, which included descriptions of the habitats and landscapes used by these species. Twenty-two major categories of threats to wildlife were identified; the top six threats were habitat loss, impacts of roads and trails, pollutants and sedimentation, invasive species, climate change, and data gaps and information needs (Vermont Department of Fish and Wildlife, 2005) .

The Vermont Wildlife Action Plan is not represented spatially. The plan addresses important wildlife habitats but does not identify where they are located. The Vermont Department of Fish and Wildlife (FW) recently undertook several projects to identify important wildlife travel corridors and large habitat blocks, and evaluate the threats to these wildlife habitats. An interactive map is also being developed by FW to assist natural resource professionals. Unfortunately, these products are not available at this time. However, we worked closely with FW to ensure that strategies, when developed, promote both our plan and the Vermont Wildlife Action Plan.

Over the past 20 years, FW has produced several specific species suitable habitat maps that range from deer wintering habitat to Indiana bat habitat. Because these maps are produced for use at the local scale, they were not included in the series of Assessment maps. However, they are very important for use in identifying locally important priority areas. Natural heritage sites have been carefully documented and mapped but the locations are not widely publicized in an effort to protect them. In addition, most are

small and not capable of being mapped on a statewide scale. For more information visit: www.vtfishandwildlife.com/wildlife_nongame.cfm

Common Flora and Fauna

One of the most important roles of our forest land is as a matrix that supports a wide array of common flora and fauna. As an example, Vermont's forests provide breeding habitat to over 70 different neo-tropical birds. However, many common species are in decline or threatened by a variety of causes. Population levels of wood thrush and the Canada warbler have declined at rates of 63% and 55% respectively (Audubon Vermont, 2010). In addition, there are emerging threats to some of our common trees; hemlocks are threatened by hemlock woolly adelgid, ash by emerald ash borer and butternuts by Butternut canker disease, to name a few. Regardless of whether these threats are caused by specific exotic pests moving into the state or are the results of forest conversion outside of Vermont, how we manage these common species will greatly influence the future. Better monitoring of Vermont's common flora and fauna, and developing strategies such as maintaining forest blocks across the landscape, will help preserve our diverse forest ecosystem. Landowner outreach including Audubon Vermont's 'Foresters for the Birds' program, along with habitat assessments and educational efforts to increase public awareness on threats to flora and fauna are important.

Population Growth, Parcelization, Fragmentation and Development

Vermont remains the second least populated state in the country and the third most rural (U.S. Census Bureau, 2000). In 2000, 608,827 residents lived in Vermont, an increase of nearly 8.2% from 1990. It is predicted that the population growth rate is likely to increase and that by 2030, Vermont will have an additional one hundred thousand residents, (Map 9: Projected Housing Density Change). The urban areas of the state will need to continue to plan for an accelerated population growth. In addition, many of the rural communities, especially in the Rural Residential Landscape Zone, will be confronted with population increases and the pressures associated with rapid development. Grand Isle County or the towns more commonly referred to as the Champlain Islands, are experiencing population growth. The county's population at the 2000 census increased 30% from 1990. Other rural areas are facing similar population growth rates. Lamoille County experienced an increase of 18% from 1990 to 2000.

Planning for the additional one hundred thousand Vermont residents depends on where they will reside. Since 2000, there have been approximately 1,400 new households

annually or an average annual growth rate of 0.6% (Vermont Housing Finance Agency, 2009). The percentage of developed land also continues to increase as a result of increased residential and commercial development, and construction of second homes which is mostly related to the ski industry.

Eighty six percent (3.8 million acres) of Vermont's forests are privately-owned, leaving 14% owned by public entities (USDA Forest Service Forest Inventory and Analysis, Northern Research Station, 2008). From 1983-2008, the number of forest landowners owning 1-9 acres more than doubled resulting in increased land parcelization. Land parcelization presents a significant challenge to Vermont's natural resource managers who strive to accommodate individual landowner's management objectives and values while trying to manage beyond property boundaries to maintain the overall sustainability of the region's entire forest ecosystem. Roads, impervious surfaces and scattered developments are further fragmenting forests and creating smaller forest patches. The combination of parcelization and fragmentation poses a serious threat to the overall ecological integrity of Vermont's native landscape.

Land conversion of farms and forests from 1982 to 1997 reveals an increase of 74,800 acres of land developed for building sites (Bolduc, et al., 2008). Of these, an estimated 31%, or 23,450 acres, came from agricultural land, whereas an estimated 68%, or nearly 51,000 acres, came from forest land. Estimates from the Natural Resource Conservation Service's Natural Resource Inventory reveal that developed land in Vermont, not including land in rural transportation uses, increased from 158,900 acres in 1982 to about 254,200 acres by 2003, a significant increase of 60% over two decades; far outpacing Vermont's population growth (Figure 4). With pressures from development, parcelization and fragmentation, the management of Vermont's forests for long-term sustainability will become progressively more challenging and necessary.

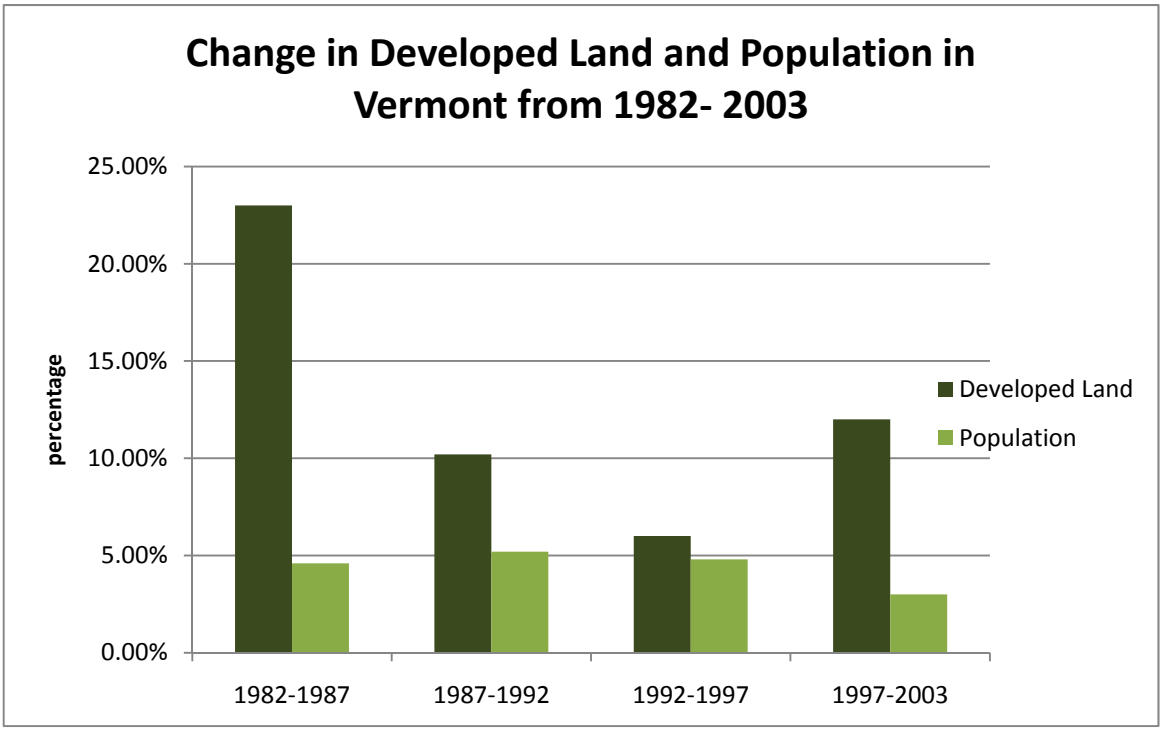

Figure 4: Change in Developed Land and Population in Vermont from 1982 - 2003. *Source: Bolduc & Kessel. Vermont in Transition, 2008*

Forest Legacy and Land Conservation

The Forest Legacy Program (FLP) is a partnership between participating states and the US Forest Service to identify and protect environmentally important privately-owned forest lands from conversion to non-forest uses. FLP acquisitions focus on conservation easements or fee purchases.

The Forest Legacy Program requires each state to select areas where the most valuable forest lands face the greatest threats (Forest Legacy Areas), determine criteria for selecting projects for possible funding, and solicit and receive input from the public. The FLP also requires an Assessment of Need (AON) to focus federal investment on priority landscapes. In Vermont, three resource values were identified in the assessment; in descending order of importance they include: size of forest block, productivity of soils and ecological resource richness, (Map 10: Forest Legacy: Analysis of Need - DRAFT), (Vermont Department of Forests, Parks and Recreation, 2009). It should be noted that these criteria were very similar to the ones used to produce the Department of Fish and Wildlife's Habitat Blocks Ranked for Conservation Value. These two separate analysis projects identified many of the same high priority landscapes and are a key component in our Assessment and identification of priority landscapes.

The AON map connects all of the scattered high scoring areas into one zone. The map represents the area in which potential Forest Legacy parcels should be considered for conservation, and encompasses 2.6 million acres or about 44% of Vermont's total acreage. Although strategies promoting land conservation are identified, Vermont's AON, pending final approval from the US Forest Service, will be the guiding document for Vermont's Forest Legacy Program.

In 2009, Vermont had a total of 368,000 acres under conservation easements. Reports from the University of Vermont Spatial Analysis Laboratory indicate that approximately 1.3 million acres or 22% of Vermont's landscape is under some form of permanent conservation, (Map 11: Conserved Lands and Map 12: Percent of Land Area Conserved by Town). This represents a success story in the efforts to keep forests forested. With success comes responsibility, however, easement monitoring and stewardship assistance have become an increased burden on personnel time. Cooperation with local conservation organizations will be critical in the coming years to ensure legal obligations are being met.

Use Value Appraisal

Concerns that high property taxes were forcing forest and agricultural landowners to sell to developers, Vermont passed the Use Value Appraisal Law in 1978. Now commonly referred to as UVA or Current Use, the program allows landowners with 25 or more acres to apply for a reduction in the assessed value of their eligible acreage from an assessment based on the standard fair market value, to an assessment based on the "use value," or a value based on what the land could produce for timber or agriculture. In exchange for this tax stabilization, forest landowners agree not to develop the land and submit a forest management plan to the state for approval.

The program has proven very popular and, as of 2009, there are over 11,000 forest land parcels enrolled. This represents over 1.5 million acres or about 30% of all the eligible private forest land in Vermont, (Map 13: Percent of Town Acres Enrolled in UVA, Map 14: UVA Average Parcel Size by Town, and Map 15: Forest UVA Parcels for Washington County).

Recent amendments to Vermont's UVA program allow for enrollment of significant habitats without the primary purpose of timber production. The criteria used to identify significant wildlife habitats include, but are not limited to: deer wintering areas; concentrated areas of American beech, oak and cherry; bat habitats; vernal pools; wildlife corridors; heron rookeries; and certain natural communities of statewide

significance. Identifying and mapping the habitats will primarily be conducted by resource professionals with assistance from agency staff. Forest management in these areas is based on Agency guidelines.

Use Value Appraisal is Vermont's most successful forestry and conservation program in its ability to maintain a large percentage of forest lands forested. This program also compliments the goals and purpose of the Forest Stewardship Program. The Department's county foresters spend roughly 75% of their time administering both programs. The UVA program may serve as the basis for Vermont's landscape scale stewardship planning in the future. Maintaining support for state policy that recognizes the importance of Vermont's 'working landscape' will be critical as the state continues to weather economic downturns.

Desired Future Condition 2: *Forest Health and Productivity*

Maintain and enhance forest ecosystem health and productivity

Healthy forests are ecosystems that possess the long-term capacity for self-renewal of their ecological productivity, diversity and complexity (ANR Sustainable Forestry Task Force Report, October, 2007). Normal climate variability and natural disturbances may disrupt this capacity in the short-term. Changes outside the historical range may threaten long-term forest health. The ecological health of forests is essential if they are to meet social needs.

Forest Productivity

The productive capacity of forest soils, (Map 16: Forest Productivity) limits ecological productivity, and may determine forest recovery or decline, (Map 23: Areas of Forest Decline Over 10 Years), following disturbance. Forest soils are a product of mineralogy, soil evolution and land use history. Acid deposition further modifies soil characteristics. Forest management techniques can influence future site productivity, (Map 24: Forest Sensitivity to Acid Deposition).

Sulfur and nitrogen deposition continue to exceed the critical acidity load for 30% of Vermont forest land (Miller, E. 2005). Soil nutrients, retained organic matter, sequestered carbon, (Map 25: Above Ground Forest Carbon (Live Tree) and Map 26: Forest Soil Organic Carbon) should be considerations in determining sustainable harvesting levels. Acceptable management practices for logging, and other watershed protection strategies, help conserve soil productivity and reduce erosion. Work is necessary to develop management recommendations that consider nutrient depletion when harvesting on acid sensitive sites and monitoring changes in forest soil nutrition. Affected states, including Vermont, need to continue to press for reduction in acid forming emissions.

One measure of forest productivity is the volume of trees, expressed as cubic feet, board feet, cords or tons. The FIA data uses cubic foot volume as a consistent, product-neutral measure that can be converted to other product specific measures. Volume, or inventory, is meaningful when looked at in combination with net growth. Tree volume in Vermont has increased, with the highest rate of increase occurring between 1983 and 1997 (Figure 5). The change from 1997 to 2008, though still positive, shows a slower rate of increase. The rate of change can vary depending on a variety of factors, including weather, past volumes harvested, forest age and relative density of trees.

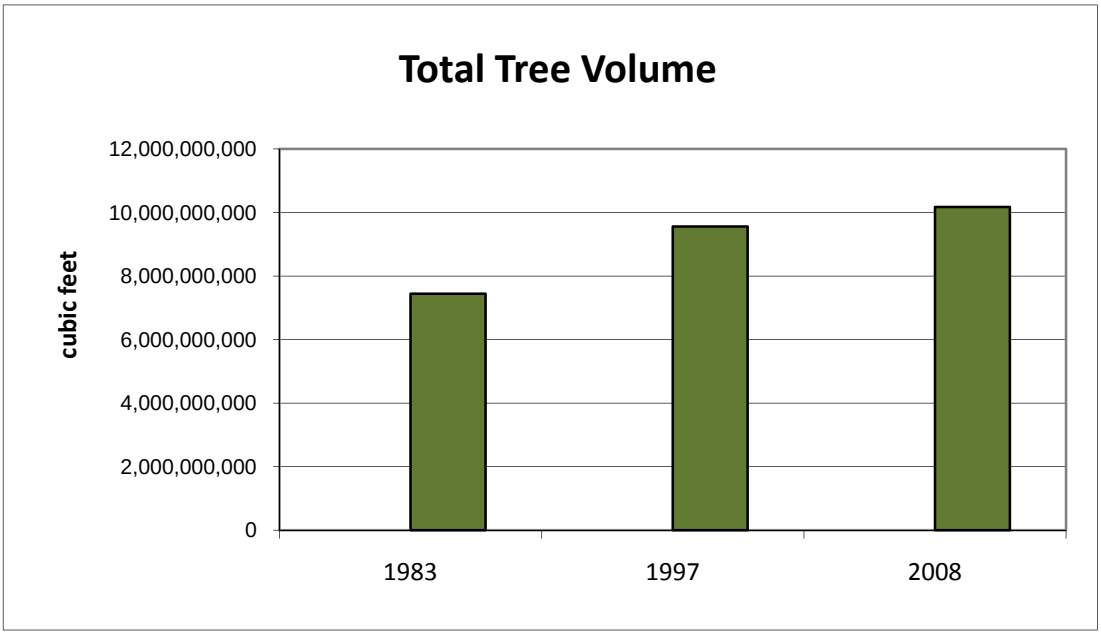

Figure 5: Total Tree Volume. *Source:* National Forest Inventory and Analysis Database, 2008

Tree Mortality Volume (Figure 6) is presented over the same time period using a different volume scale. Volume lost to mortality was roughly 5,000,000 cubic feet between 1983 and 1997. That measure increased to nearly 10,000,000 between 1997 and 2008. This may account for the decline in net growth. "Removals" is a measurement term that includes the volume of timber harvested annually and the volume of trees on land categorized as unavailable for harvest (USDA Forest Service Forest Inventory and Analysis, Northern Research Station, 2008). Decreases in the available land base can occur due to land use change resulting from development, conversion to agriculture or from change in land use designation such as wilderness or natural area. Figure 7 summarizes the annual removals by volume for the time period from 1983 to 2008. The data does not allow a distinction to be made between volume of harvest and volume associated with land use change. This change is similar between 1983 to 1997 and 1997 to 2008. Priorities include working with partners to identify locations, characteristics

and probable cause(s) for increased mortality observed in the current FIA data, especially as it relates to future forest productivity.

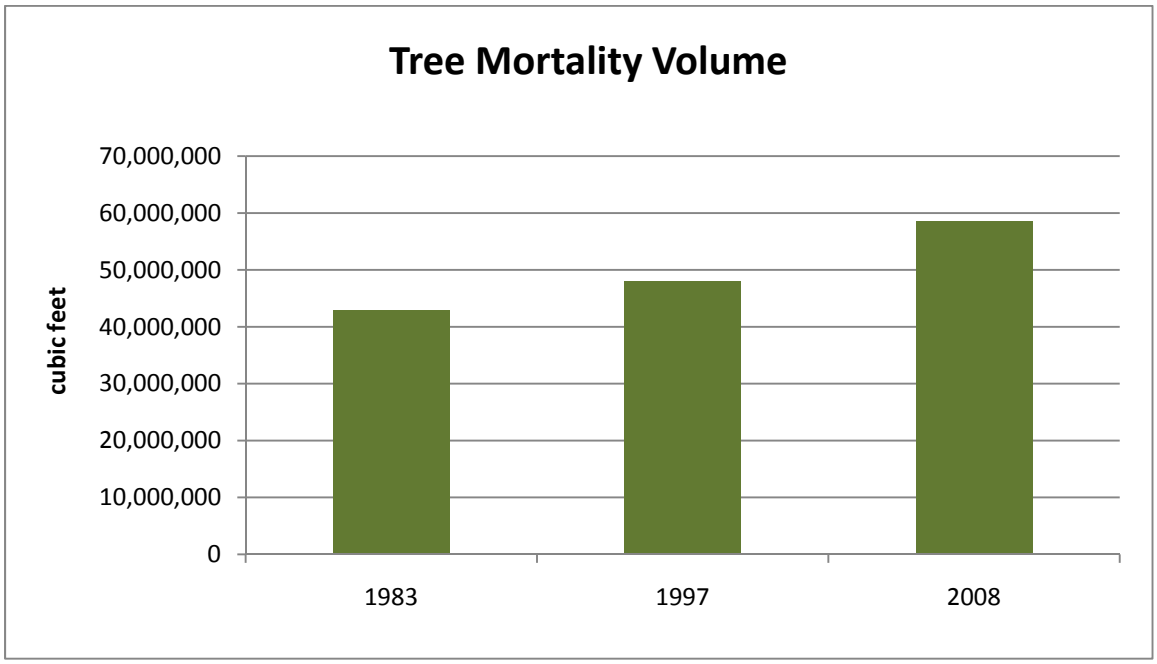

Figure 6: Tree Mortality Volume. *Source:* National Forest Inventory and Analysis Database, 2008

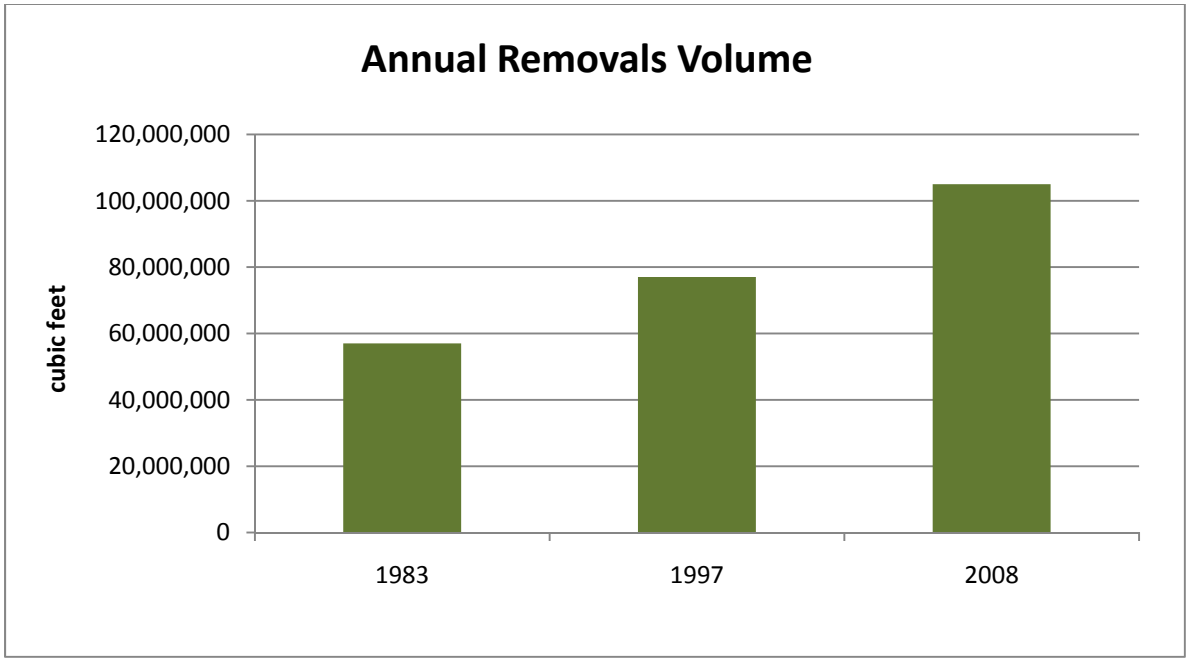

Figure 7. Annual Removals Volume. *Source:* National Forest Inventory and Analysis Database, 2008

Non-Native Invasive Species

Non-native invasive species cause irreversible impacts on tree health and biodiversity. Three non-native insects which currently threaten Vermont are the emerald ash borer, Asian longhorned beetle and hemlock wooly adelgid. Areas of potential risk have been mapped based on locations of host species and likelihood of insect introductions (USDA Forest Service, Forest Health Technology Enterprise Team, 2010), (Map 27: Susceptibility Potential for Emerald Ash Borer, Map 28: Susceptibility Potential for Asian Longhorned Beetle, and Map 29: Susceptibility Potential for Hemlock Woolly Adelgid). Only hemlock wooly adelgid is currently present in the state; emerald ash borer and Asian longhorned beetle are within fifty miles of Vermont's border. Over half of the trees in Vermont are host species of one of these three insects. A number of exotic insects and diseases, such as beech bark disease, butternut canker and gypsy moth, are already established statewide. Other potentially threatening pests have been introduced to the continent, but have not been found in Vermont. Conserving genetic diversity within native host species increases potential resiliency in light of invasive pests and other anthropogenic stresses. To address non-native invasive species, we need to prevent new introductions through common pathways such as firewood, nursery stock and other non-local products; prepare for new invasions by planning and preserving germplasm; work with partners to develop tools for detecting, identifying, evaluating and managing invasive pests; and respond rapidly if infestations are detected.

Invasive plants in Vermont have also been shown to play a role in regeneration failures of native tree species, (Map 30: Non-native Invasive Plant Occurrence). They successfully out-compete native plants and aggressively respond to disturbances that open forest canopies or disturb soils (Collier & Vankat; Fagen & Peart, 2004; and Webster, Jenkins & Jose, 2006). Invasive plant growth can lead to loss of native flora and fauna. We have little comprehensive information on the distribution of terrestrial invasives in forest land. There are limited means for control, but many landowners are looking for both technical and financial support.

Climate Change

Climate change may have gradual and long-term impacts on forests (U.S. Geological Survey, 2009). It is probable that the changing climate will affect biodiversity, productivity, forest structure and ecosystem services. There will be initial short-term impacts as forests try to adapt to environmental change and long-term impacts as a new forest evolves. Currently, scientists in Vermont are detecting changes in forest species distribution in high elevation spruce-fir forests (Beckage, et al., 2008). Predicting future

changes is complex, making it difficult to develop new forest management strategies. Planning for climate change will require working with local and regional partners. A short-term goal will be an assessment of forest vulnerability and the development of a climate change adaptation plan. Mapping locations that might serve as potential refugia for spruce-fir forests will assist discussions on possible management strategies that prolong the survival of these forest ecosystems in Vermont, (Map 31: Potential Climate Change Refugia).

Acid Deposition

Acid deposition threats to forest sustainability are generally accepted. Although impacts can affect all parts of the forest system (i.e., increased winter injury on red spruce trees), soil productivity is of particular concern to forest health. Acid deposition can increase leaching of valuable soil nutrients making them unavailable for tree growth (Driscoll, Lawrence, et al., 2001). Of particular concern are calcium depletion and aluminum toxicity; both have been shown to adversely affect sugar maple growth (Long, et al., 2009). A recent international project requested by the New England Governors and Eastern Canadian Premiers mapped forest sensitivity to acid deposition providing a tool to develop Vermont-specific guidelines to inform forest planning (Miller, E., 2005), (Map 24: Forest Sensitivity to Acid Deposition).

Natural Disturbances

Natural disturbances, such as native insects and diseases and extreme weather events, have always had impacts on forest dynamics, forest products and services. Human activities can directly affect forest health and sustainability, including planting monoculture or certain harvesting practices. Inadvertent introductions of exotic pests or creation of habitat that favors undesirable species are also disturbance issues for forests on different levels. Managing for natural disturbances includes continuing monitoring activities to map disturbances annually, (Map 23: Areas of Forest Decline Over 10 Years) diagnosing forest health problems, surveying changes to native and exotic pest populations, working with partners to develop management tools that reduce long-term forest health impacts, and providing education and outreach to landowners, foresters and other groups to promote forest health goals.

Forest Health Management

Forest health management involves a variety of strategies. Appropriate response focuses resources where they are most likely to protect forest health. This depends on access to information from local observations, other regions, historical records and

current research; it requires collaboration between government organizations, landowners and other groups; and it requires evaluation of potential impact. Because forest health issues don't recognize political boundaries, a coordinated regional approach is critical to address them on a landscape scale. The most effective strategies to protect priority landscapes may be undertaken far from these priority areas.

Flexibility is needed to respond to emerging situations that threaten forest health. Monitoring changes in tree crown condition may be early indicators of unidentified damage causing agents. Diagnostic follow-up may require specialized skills, including entomology and pathology expertise. More information is needed to guide management strategies in many areas. Integrated methods can be supplemented by direct control, such as suppression and eradication, when necessary, to prevent imminent damage.

Wildland fire does not pose a serious threat to Vermont forests, but the state does have fire seasons in the spring and fall, (Map 32: Vermont Wildfire Risk Assessment).The majority of wildland fires occurs in April and May, and usually involves small grass fires that escape homeowner's control.

While forest fires have historically impacted forest health and productivity, the discontinuance of clearing and burning forest land for conversion to agriculture and improvements in fire suppression technology have greatly reduced the occurrence of large wildland fires. Wildland fire concern in recent times has focused on risk to homes nestled in wooded areas (Wildland-Urban Interface). On a small scale, the State of Vermont uses prescribed fire to maintain early successional forest habitats and promote regeneration of species favoring disturbance on state-owned lands.

The Division of Forests works with local Regional Planning Commissions to implement Community Wildfire Protection Plans (CWPP's). Two plans have been prepared to date, (Map 33: Community Wildfire Protection Plans in the Northeast). These plans assist certain towns in identifying and mitigating wildland fire risk within their community. One of the methods of reducing wildland fire risk is through prescribed burning to reduce hazardous fuels. The Division of Forests provides formal prescribed burn plans and on-site support when the prescribed burns are accomplished.

The Division administers the Town Forest Fire Warden program which requires all towns within the state to have an appointed fire warden. Division fire personnel develop and provide training for municipal and volunteer fire fighters in wildland fire suppression.

The Division's fire personnel are not first responders to wildland fires, but are available on request for on-site technical support and specialized equipment. Our forest fire program focuses on prevention, fire awareness and fire fighter safety. In cooperation with the National Weather Service, the Division provides fire weather data to federal, state and local officials.

Vermont does contribute to regional and national fire control efforts. Annually, state personnel attend fireline safety refreshers and work capacity tests to become qualified wildland firefighters. Vermont is a member of the Northeastern Forest Fire Protection Commission (COMPACT) and each year qualified fire fighters are available to respond to interagency requests for support.

Desired Future Condition 3: *Forest Products and Ecosystem Services*

Maintain and enhance forest contribution to ecosystem services

Vermont's forests have ecological, economical and social value. Benefits people obtain from forest ecosystems help sustain and fulfill human life. Vermont's working landscape supports a forest products industry estimated to generate over 1 billion dollars annually in the state and helps private forest landowners cover ownership costs. Our clean air and water are in large part due to the filtering effects of trees above and below ground. Forests provide food, fresh water, fuel and fiber. They support functions such as maintaining soil fertility, cycling of nutrients (carbon sequestration & air pollution filtering) and providing habitat for plant and animal life. Forests reduce the effects from climate (drought), weather (flooding, strong winds) and insect and disease problems (natural controls). Forests represent a part of our lives that we value for education, aesthetics, rural forest-based economy, recreation, tourism and cultural heritage.

Wood for Energy

As regional pulpwood demand declined over the past decade, opportunities for marketing lower grade wood became increasingly difficult. The one bright spot during this period has been an increase in demand for wood for energy. A recent study of residential firewood consumption shows an increase from 275,000 cords per year in 1997 to 315,000 cords per year in 2008 (Vermont Department of Forests, Parks and Recreation and Department of Public Service, 2009). Increase in demand for wood fuel has also come from growth in institutional and commercial use. Between 1983 and 2008, 35 schools in Vermont converted from fossil fuels to the use of wood chips for heating. These successes, combined with the high cost of alternative fuels, have many speculating that there will be a substantial increase in the demand for wood fuel in the next 10 years.

Some projections have been made regarding the sustainability of Vermont's forest to meet this new anticipated demand for wood for energy (Biomass Energy Resource Center). These projections range from as little as 400,000 green tons (over and above current harvest levels) to as much as 2.4 million green tons per year. It needs to be noted that estimates like these are intended to address energy development potential more from a statewide policy perspective rather than offering detailed information suited to project development.

The capacity to sustain increased wood supply for energy production may be additionally constrained by external factors including the number of loggers employed, limits on combustion emissions and the capacity of Vermont's forests to grow fiber.

Wood Product Manufacturing

Vermont's forest products economy is not just a local economy, but part of a regional and world economy. Vermont sawlogs and other primary forest products such as wood chips are sold and processed all over the northeast, and secondary wood products from Vermont are sold around the world.

As of the beginning of 2010, the sawmill industry in Vermont is entering its eighth consecutive year of economic challenges. This contributed to a slow but steady decline in the number of sawmills operating in the state. A major decline in construction as well as a major recession starting in late 2008 has caused further contraction in this sector. From 2004 through the middle of 2007, poor logging weather limited log supply while keeping log prices high.

Figure 8 shows the number of commercial sawmills operating in Vermont from 1983 to 2008 (Vermont Department of Forests, Parks and Recreation, 2008). As the number of sawmills decline, there is a point where the number becomes too small to adequately provide the market diversity that foresters and landowners require to be able to market forest products. A broad range of forest products business sizes and specialties is key to exemplary forest management.

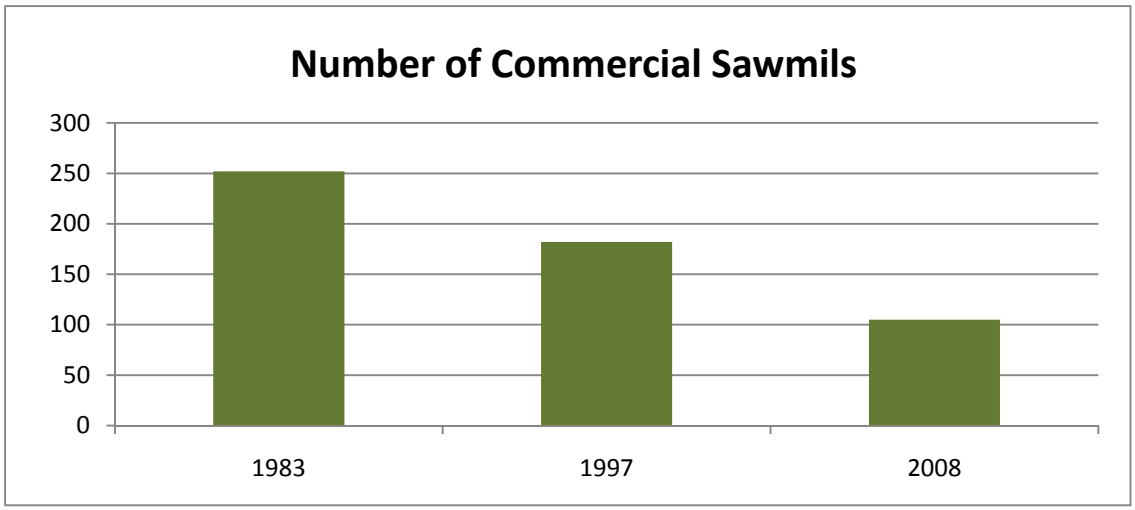

Figure 8. Number of Commercial Sawmills. *Source: Vermont Department of Forests, Parks and Recreation, Division of Forests, Annual Harvest Report, 2008.*

It is widely recognized that the further the distance sawlogs must travel to a mill, the lower diversity in species and quality accepted by the mills. This makes sense since the cost of harvesting and transporting logs is the same regardless of quality of any given log. As transport distance goes up, so does cost, reducing the profit margin for marginal species and grades. An adequate number of sawmills throughout a region plays a very important role in supporting quality forest management in Vermont's diverse forest.

Vermont's secondary wood product manufacturing sector has also declined in the past few years. The closure of Vermont Tubbs and Ethan Allen's furniture manufacturing operations have been the most significant large-scale company losses, while several others have scaled back production substantially. Over the past ten years, the manufacturing sector has developed two associations and an industry-wide marketing council in partnership with the Division of Forests. Vermont WoodNet and Vermont Wood Manufacturing Association now represent a majority of wood product companies. The Guild of Vermont Furniture Makers adds the high-end of furniture to the list. These three associations collaborate with Vermont Woodlands Association, Vermont Forest Products Association and Consulting Foresters Association of Vermont, through the Vermont Wood Products Marketing Council, to promote the Vermont brand and to work on specific marketing projects.

Timber Harvesting

Most forest land in Vermont is privately-owned by individual landowners who occasionally sell their standing trees to the forest products industry as "stumpage." In 2008, an estimated total sale of stumpage earned by Vermont landowners was about $22 million (Vermont Current Use Advisory Board, 2010).

Figure 9 provides information on the harvest of forest products in Vermont during 2008, the most recent year for which data are available. During that year, 89.2 million board feet (178,464 cords) of hardwood sawlogs and 83.9 million board feet (167,742 cords) of softwood sawlogs were harvested from Vermont's forests, totaling 173.1 million board feet (346,206 cords). Vermont's pulpwood harvest was 145,218 cords. The biomass chip harvest totaled 231,817 green tons (92,727 cords). These chips are used primarily as fuel in wood to energy facilities but are also in demand for wood pellet production, composting and mulch.

Figure 9 also shows export, import and processed volumes for the respective products. Import and export volumes for residential firewood are not known, though some trade in each direction is recognized. All pulpwood harvested in Vermont is shipped out of

state for further processing into pulp and paper. Although the state is host to paper making businesses, none have pulpwood conversion capability. The historic condition of higher volume of softwood log exports than hardwood is shown, as is the reverse relationship for log imports.

Residential firewood harvest volume is estimated to be 315,000 cords for the year. This is the largest volume by product category. It is important to note that it is often the case that a single tree yields a variety of products: sawlog, pulpwood, biomass chips or firewood. In future harvest trend assessments, it may be useful to express volumes in tons rather than cords. Although a cord is generally understandable to a general audience, measuring harvest and inventory in tons can provide a more accurate accounting, especially if more whole tree utilization occurs.

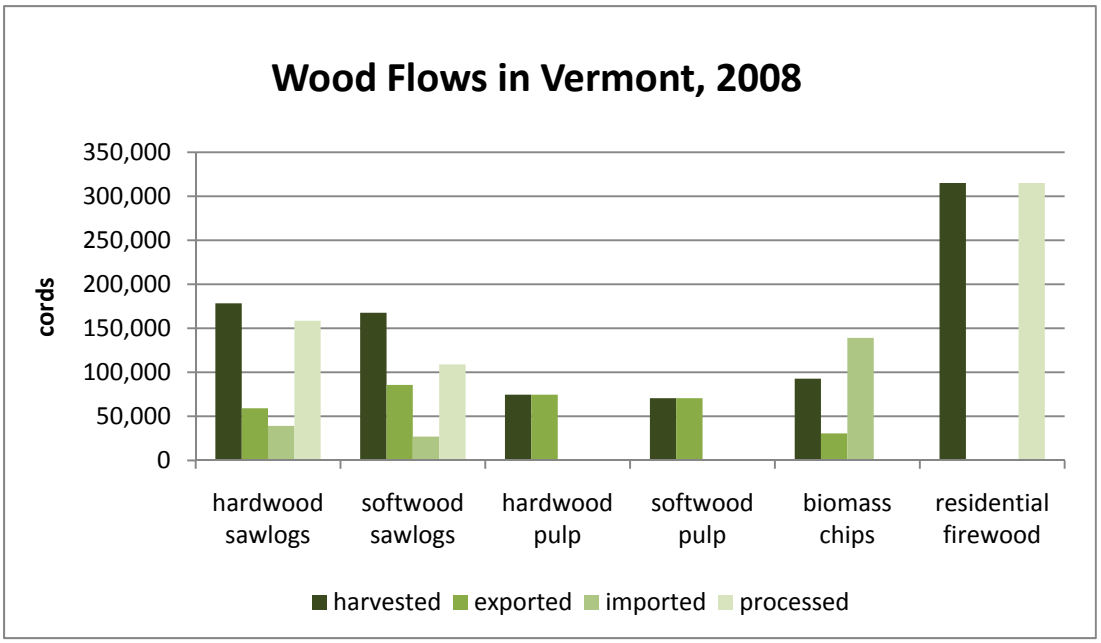

Figure 9. Wood Flows in Vermont, 2008. *Source: Vermont Department of Forests, Parks and Recreation, Division of Forests, Annual Harvest Report, 2008.*

Cultural and Non-Timber Forest Products

Interest in non-timber forest products is increasing rapidly. These include medicinal and herbal products such as ginseng and golden seal; decorative products including holiday greenery and vines; edible products such as shitake mushrooms and various nuts; to specialty products such as brown ash for basketry. Forest landowners should be encouraged to manage these resources sustainably.

Vermont is the nation's leading maple syrup producer with operations distributed around the state in small family businesses with a handful of large operations (New

England Agriculture Statistics, 2009). Vermont maple syrup production in 2009 was 920,000 gallons, the highest production since 1944, and an increase of 30% from 2008. Modern sugarmakers rely upon vacuum and tubing sap distribution, reverse osmosis sugar concentration and super-efficient evaporation systems. 'Sugaring season' still remains a quintessential Vermont tradition.

The Vermont Christmas tree industry has also been increasing production. In 2007, 168,206 trees were harvested, an 11% increase from 2002 (USDA Agricultural Statistics Service). An estimated 255 tree farmers benefit from growing Christmas trees in the state.

Recreation

Forest-based outdoor recreation is a major component of Vermont's economy. Popular winter outdoor sports include downhill and cross-country skiing, snowmobiling, dog sledding, ice climbing and snowshoeing. In 2007-2008, Vermont logged over 4.3 million skier visits (Vermont Ski Area Association, 2009), among the highest in the US. Vermont has 35,000 registered snowmobilers in 138 clubs around the state (Vermont Association of Snowmobile Travelers). Summer and fall activities include hiking, camping, hunting and fishing, mountain biking, bird watching and geocaching.

Outdoor recreation continues to grow in popularity in Vermont. Over the past 20 years, there has been a shift in the types of outdoor activities people are participating in, away from pursuits such as hiking, towards more specialized activities. There is an increased demand for trails to meet the wide variety of activities. Public land managers are finding it difficult to maintain recreational trails and structures due to increased and diversified use. Maintaining Vermont's recreational opportunities will be a challenge for the future.

Statewide trail organizations such as the Green Mountain Club, Vermont Association of Snow Travelers, the Vermont Mountain Bike Association, Vermont Horse Council, Catamount Trail Association and the Vermont All-Terrain Sportsmen's Association work with state and federal agencies to coordinate and promote their activities. Their primary purpose is to manage a statewide trail network, which relies on the use of both public and private lands. Maintained recreational trails in Vermont total over 8,100 miles (Vermont Department of Forests, Parks and Recreation, 2010) and only made possible by the cooperation between federal, state and private landowners

Wildlife-based activities including hunting, fishing, trapping, viewing and photography are important cultural elements of life in Vermont. Based on a 2001 survey of residents involved in wildlife-based activities, Vermont ranked second only to Alaska in participation by residents. A national survey conducted by the US Fish and Wildlife Service in 2006 found that 41% of Vermont residents hunted. The US Fish and Wildlife Service estimated in 2006 that wildlife-based activities contributed over $383 million dollars to Vermont's economy. This same survey indicates that over 545,000 residents and non-residents participated in wildlife-based activities in 2006. Clearly, fish and wildlife resources, and the lands and waters that support them, are critically important to the quality of life for those who live in and visit Vermont.

The Vermont Fish and Wildlife Department owns 85 Wildlife Management Areas, numerous riparian properties and over 170 fishing/boating access areas statewide totaling nearly 130,000 acres. These lands play a critical role in the Department's ability to achieve its mission and in supporting the public's quality of life in terms of maintaining connections to the land. Management of these areas emphasizes the conservation of fish and wildlife, and their habitats, and the properties provide important public access and opportunities for hunting, fishing, trapping and other fish and wildlife-based activities.

Carbon Sequestration and Storage

Climate change represents both a challenge to forest sustainability and an opportunity to highlight the value of forests and forest products in providing temporary mitigation of greenhouse gas emissions through carbon sequestration and storage. Vermont's greenhouse gas emissions in 2005 were estimated at 9.07 MMtCO2e[5] (Governor's Commission on Climate Change Report, October, 2007). Carbon storage in forests and wood products was estimated at 9.0 MMTCO2e, which contributes significantly to reduce total greenhouse gas emissions. To reduce Vermont's emissions to 1990 levels by 2028 requires an increasing role for forest sequestration. Protection of forests with high carbon storage, (Map 25: Above Ground Carbon (Live Tree) and Map 26 Forest Soil Carbon), and implementation of forest management strategies that increase carbon sequestration and storage in forests with low carbon are needed to reach 1990 emissions targets. Yet pressures from forest conversions, harvesting for wood energy, infestations of non-native destructive pests or changes in private or public land management can alter the extent of forest mitigation of greenhouse gases. In urban forests, increasing canopy cover not only expands sequestration possibilities, but can

[5] Million metric tons carbon dioxide equivalent.

change air temperatures leading to reduced energy needs for heating and cooling buildings (Carbon Storage and Sequestation by Urban Trees in the USA, 2002).

Air Quality

It is well established that tree and forest canopies cleanse air by filtering air borne pollutants. Trees sequester many pollutants from the atmosphere, including nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particulate matter of ten microns or less (PM_{10}). Air pollution removal by urban forests in one city, Washington DC, was calculated at 878,000 pounds per year (Nowak & Crane, 2002). At the same time, the release of volatile organic compounds from trees can influence the production of ground level ozone. Air quality monitoring shows that Vermont has made improvements in sulfur dioxide pollution and the state is currently within national standards for criteria pollutants. However, our state is still affected by poor visibility on summer days, acid deposition on sensitive forests, ozone injury on sensitive plants and increasing atmospheric carbon dioxide (U.S. Environmental Protection Agency). Currently, Vermont towns and cities are working to increase urban canopy cover to reduce stormwater flow, mediate air temperatures, mitigate carbon emissions and filter air pollutants.

Water Quality

Impaired Waters from Nonpoint Source Pollution

Pursuant to Section 303(d) of the federal Clean Water Act, seventeen of Vermont's waterways are listed as "impaired" primarily due to urban stormwater runoff, (Map 39: Priority Areas for Urban Tree Canopy Enhancements). Three watersheds are impaired due to ski area development. Once a waterway is listed as impaired, it is scheduled for the development of a Total Maximum Daily Load (TMDL) target. A TMDL is an EPA approved target which attempts to limit and allocate discharge loads among the various dischargers to impaired waters in order to assure attainment with water quality standards.

The Lake Champlain phosphorus TMDL was prepared jointly by Vermont and New York, and was finalized in 2002. Nonpoint Source Pollution (NPS) contributes about 90% of the total phosphorus load to Lake Champlain (Lake Champlain Basin Program, 2010). A 2007 report for the Lake Champlain Basin Program (LCBP) estimated the contribution of NPS phosphorus from major land use types: Agricultural Land (38%), Urban and Other Developed Land (46%) and Forest Land (15% phosphorus). The TMDL included a Vermont-specific implementation plan describing a suite of action items and attendant

funding needs to reduce the phosphorus load delivered annually to Lake Champlain. The TMDL led to Vermont's Clean and Clear Action Plan in 2003. The plan's goal is to accelerate the reduction of phosphorus pollution in Lake Champlain and reducing related pollutants in waters statewide (Vermont Clean and Clear Plan, 2009).

While millions of dollars have been spent on the clean-up effort of Lake Champlain over the past 20 years, positive results have been slow in coming. The Lake Champlain Basin encompasses the towns with the highest growth rates in Vermont and with this development comes more stormwater runoff and reduced forest canopy cover, (Map 34: Vermont Major Watersheds). Improving green infrastructure and low impact development practices will help to minimize stormwater runoff. The Champlain Basin also has the highest percentage of farm land in the state which is another major contributor to phosphorous pollution. Unlike the growth in urban areas, the trend in agriculture is declining as Vermont farms are struggling to stay in business. With this decline in agriculture, comes an opportunity to restore forested riparian areas, wetlands and bottomland hardwoods in the Champlain Basin. A major challenge that Vermonters face in protecting these ecologically valuable lands is the threat of land conversion for development.

A 2007 report for the LCBP estimated that 8-15% of the total nonpoint source phosphorus load delivered to Lake Champlain comes from forest land. Work continues statewide to accelerate the implementation of practices to protect water quality during timber harvesting operations. Stream crossings used during harvesting have been a particular area of concern in eliminating discharges of sediment. With forests covering more than 4.6 million acres and representing 78% of Vermont's total land base (National Forest Inventory and Analysis Database, 2008), forestry continues to be an area worthy of efforts to reduce sedimentation and phosphorus loading to state waters.

Public Drinking Water Supplies

In order to protect public drinking water supplies, public water systems[6] in Vermont are required to develop Source Protection Areas (SPAs), (Map 35: Water Source Protection Areas) and subsequently, Source Protection Plans after the State Water Supply Division has approved the SPA. State rules regulate activities within SPAs. SPAs are considered in the development of forest management plans on both state and federal land in Vermont and with statewide emergency response plans.

[6] Vermont Public Water System is a water supply that provides drinking water to the public and has at least 15 service connections or serves an average of at least 25 individuals for at least 60 days a year (Vermont Department of Environmental Conservation Water Supply Rule, 2005).

In Vermont, public water supply systems are divided into three categories: surface water, ground water and ground water under the influence of surface water. Drinking water sources are identified and the corresponding recharge area or source protection area is mapped or delineated. Table 3 depicts the number of users of public water systems by water source (Vermont Department of Environmental Conservation, Water Supply, 2010). A public water system has the potential of serving a customer more than once. For example, someone may get water at home from the same public water system that serves that person's workplace. Both public and private sources of groundwater (wells and springs) serve the majority of Vermont households. However, public surface water systems tend to serve major urban areas where populations are concentrated and multiple uses are occurring; domestic, industrial and commercial.

Vermont Public Water Supply Systems

Water Source	Population Total	Number of Systems	Source Protection Area (Acres)
Ground Water Under Influence of Surface Water	1,845	6	176,206
Ground Water	219,532	563	
Surface Water	248,355	39	240,082
Totals	469,732	608	416,288

Table 3. Vermont Public Water Supply Systems. *Source: Vermont Department of Environmental Conservation, Water Supply, 2010*

Historically, Vermonters have benefited from an abundance of high-quality drinking water. Protection of this resource is becoming more difficult as development pressure and competing land uses threaten both water quantity and quality, (Map 36: Land Classification of Vermont Headwaters). The price that Vermonters pay for protection of drinking water sources continues to rise (Agency of Natural Resouces, 2002).

Private Forests and Drinking Water

The US Forest Service, State and Private Forestry publication "Forests, Water and People," identified private forests in the Northeast and Midwest that are most important for drinking water supply and most in need of protection from development pressure (Barnes, et al., 2009). Nine layers of GIS data were combined to produce four indices of watershed importance for drinking water supplies and the need for private

forest management to protect those supplies. The four indices are: mean ability to produce clean water for watersheds; important watersheds for drinking water; private forests in important watersheds; and development pressure on private forests in important watersheds.

The results of the analysis indicate that Vermont ranks high in the ability to produce clean water. The analysis also indicates that forest land serves an important role in providing clean drinking water to consumers. Looking to the future, the major area of concern for Vermont is projected development pressure in the Winooski and Middle Connecticut watersheds, and the potential impact that it could have on water quality and water supply, (Map 37: Development Pressure on Private Forests in Drinking Water Supply Watersheds). These watersheds deserve the highest priority for protection and conservation to protect public drinking water supplies. Maintaining forest cover by assisting private forest landowners in meeting their management objectives and stabilizing land ownership costs are critical to maintaining Vermont's clean water.

Stream Crossings on Logging Jobs

The US Forest Service - Northeastern Area, Best Management Practices (BMP) Protocol: "Monitoring Implementation and Effectiveness for Protection of Water Resources" was conducted in Vermont in 2004. The assessment revealed that culverts, along with ford crossings, are the most commonly used structures to cross streams. Of the 94 stream crossings examined, fords were installed on 23 crossings; culverts on 26 crossings; and bridges on 14 crossings. Stream crossing structures had been removed on the other 31 stream crossings (Figure 10). Thirty-seven percent showed evidence of sedimentation. Characteristics of improperly installed crossings include: passage barriers for fish, amphibians and macro invertebrates; bank instability from inadequate compaction and excessive slopes; alteration of stream flow; inadequate maintenance; and premature failure often proceeded by prolonged erosion.

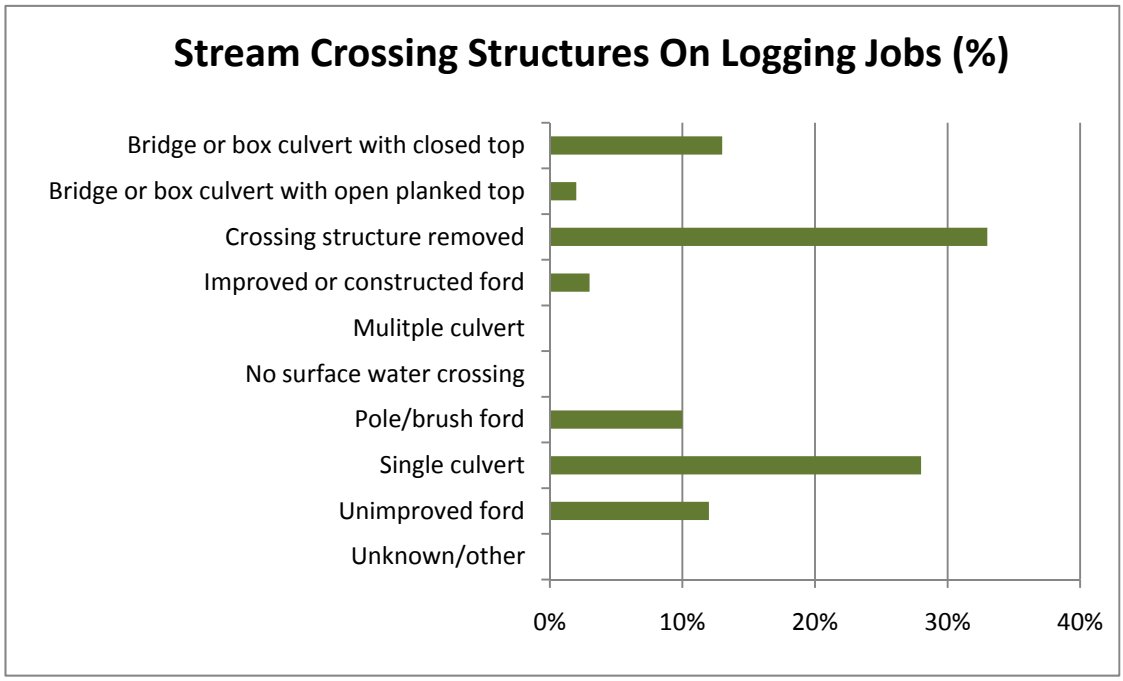

Figure 10. Stream Crossing Structures on Logging Jobs (n=94). *Source: The U.S. Forest Service - Northeastern Area, Best Management Practices (BMP) Protocol*

The results of that assessment revealed that stream crossing practices on logging operations is still an area of concern for sedimentation as well as aquatic organism passage. In addressing this concern, the Division has launched the *Portable Skidder Bridge Initiative* to promote better stream crossing practices. The goals of this initiative are to: inform loggers, landowners and foresters about the benefits of using portable skidder bridges through information and education; offer programs that provide loggers access to portable skidder bridges; and assist businesses in the fabrication and sale of portable skidder bridges.

Riparian Buffers

Much of the land adjacent to streams and rivers in Vermont has been deforested over the past 200 years to accommodate the development of roads and railways, residential and commercial development and agriculture. The loss of streamside trees and shrubs – also called riparian buffers – has resulted in lasting ecological and economical impacts throughout Vermont's watersheds. Healthy, well-vegetated riparian buffers are essential to good water quality and aquatic habitat. The re-establishment of buffers through planting trees is one of the most effective ways to improve water quality, reduce erosion and flood damage, and maintain healthy fisheries in our waterways.

For the past several years, a major effort has been underway in Vermont to restore forested buffers along rivers and streams. Much of this work has been targeted on agricultural land and is being accomplished through the Conservation Reserve

Enhancement Program (CREP). At the close of the 2009 fiscal year, total CREP enrollment reached 2,162.7 acres, which can be estimated to cover over 357 miles of streambank assuming average buffer widths of 25´ for grass and 35´ for trees (Vermont Clean and Clear Plan, 2009).

The Vermont League of Cities and Towns (VLCT) Water Quality Coordinator works with towns primarily in the Lake Champlain Basin providing technical assistance to support water quality enhancements to town zoning regulations and other municipal ordinances. In 2007, the VLCT developed a Model Riparian Buffer Ordinance for towns to consider in zoning for water quality protection. Based on an evaluation of the most current town zoning or other applicable regulations, 29 out of the 136 towns in the Lake Champlain Basin are considered to have fully met criteria for having "good" local regulations in place for water quality protection.

Riparian Buffer Guidelines were developed and adopted by the Agency of Natural Resources in 2005. The guidelines direct Agency staff in developing buffer recommendations for Vermont's land use law (Act 250) jurisdictional projects and other processes using the applicable Act 250 criteria, including public utility projects that are reviewed and permitted by the Vermont Public Service Board.

Buffer protection on timber harvesting operations is provided for in Vermont's "Acceptable Management Practices (AMP) for Maintaining Water Quality on Logging Jobs." Specific AMP guidelines regarding stream buffers call for keeping logging equipment 25 feet away from streams to prevent ground disturbance. Within buffer strips, only light thinning or selection harvests are suggested to provide shade for minimizing stream temperature fluctuations. Buffer width is determined by percent slope, starting at 50 feet for slopes up to 10 percent.

Desired Future Condition 4: *Land Ethic*

Maintain and enhance an ethic of respect for the land, sustainable use and exemplary management

Land ethic is appreciating the value of the land and understanding and accepting responsibility for our impacts on a finite, non-renewable resource. To help foster a responsible land ethic, we must first know who has an impact on the land and in what ways: who owns, lives and uses Vermont's forest? We need to understand the programs, both public and private, that are developed to encourage public awareness, involvement and stewardship activities. Measuring how effective our collective efforts are on cultivating a strong land ethic will help us to evaluate and adapt. And finally, we, the Division of Forests, must serve as role models on the lands that we manage.

Ownership of Forest Land

Public lands in Vermont falls into three broad categories: federal, state and municipal. As of 2009, Vermont's 892,894 total acres of public land includes 445,933 acres of federal lands, 396,296 acres of state lands and 50,665 acres of municipal lands, (Figure 11 and Map 11: Conserved Lands).

Figure 11. Forest Land Ownership in Vermont. Source: *Vermont Department of Forests, Parks and Recreation*

While there are significant differences in the management styles and land management emphasis, all public lands share similar concerns. The trend best summarizing the concerns is an increasing public demand at a time of decreasing management resources. In Vermont, the public has taken an interest in how public lands are managed. There is a desire to have a say in how resources are allocated with assurance that management is sustainable. Concerns relating to timber harvesting on federal land are commonplace. Allocating financial and personnel resources is perhaps the land manager's biggest challenge. Traditional interests such as timber harvesting are perceived to be competing with a wilderness experience, wildlife and water advocates, and recreational users.

Timber management still remains a priority on public lands. Approximately 2 million board feet and 3.9 million board feet are harvested annually from state land and the Green Mountain National Forest respectively. These volumes are below the 'allowable cut'[7] and 'allowable sale quantity (ASQ)'[8] from both agencies in terms of sustainability, and reflect resource constraints of public land managers and competing interests from public land users.

The Agency of Natural Resources (ANR) holds easements on over 140,000 acres of privately-managed forest land. ANR is responsible for monitoring the properties to assure continued compliance with the easement conditions and provide stewardship assistance to the landowners. Many of these landowners are relatively new to the full suite of stewardship opportunities and nearly all of them are new to managing land with conservation easements. All can benefit from training aimed at understanding easement restrictions and learning about sustainable forest management practices.

Private woodland ownership currently covers 3,864,000 acres of the total acres of timberland in the state (86%) (USDA Forest Service Forest Inventory and Analysis, Northern Research Station, 2008). Although this is the largest single category of ownership, private landowners don't represent a consensus of management goals, objectives or practices.

[7] The maximum volume of wood that can be harvested from a specified area within a specified time period. An amount up to this volume is allowed to be harvested through a legal or statutory authority which has enforcement capability.

[8] The amount of timber that may be sold within a certain time period from an area of suitable land.

The number of parcels has grown from 61,900 parcels in 1983 to 88,000 in 2008, (Figure 12) (USDA Forest Service Forest Inventory and Analysis, Northern Research Station, 2008). This is a rate of increase of a little over 1,000 new parcels per year. It is clearly shown in Figure 12 that the growth occurred in the smallest parcel size categories: 1-9 acres and 10-19 acres. The total acres in private ownership have declined from 3,992,600 acres in 1983 to 3,864,000 in 2006.

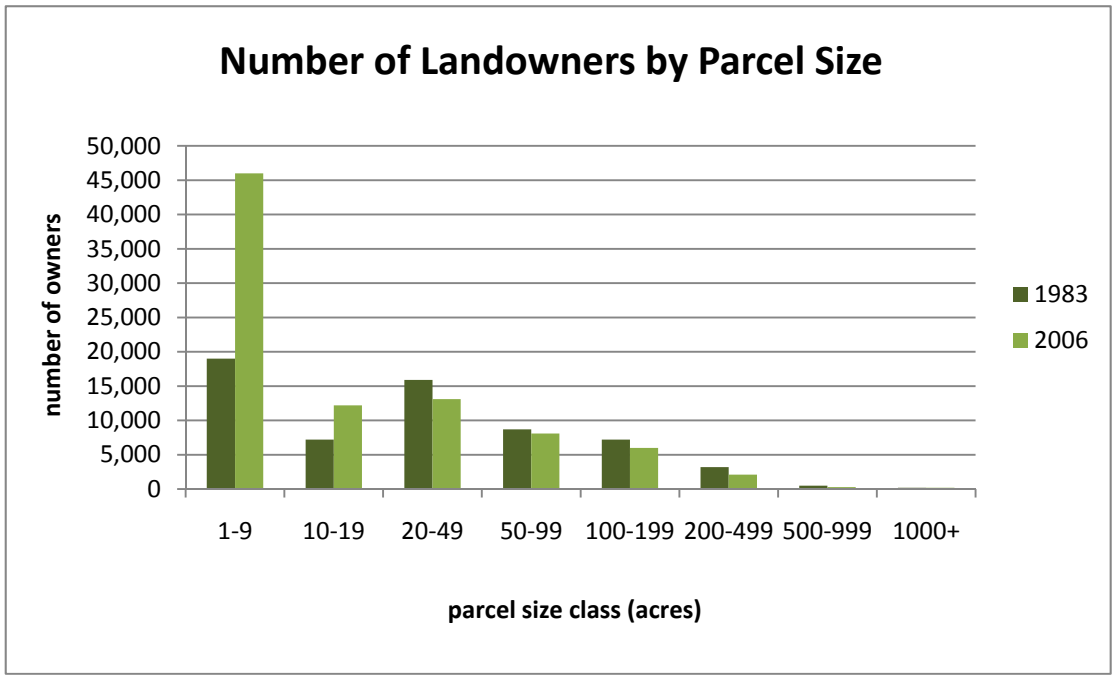

Figure 12. Number of Landowners by Parcel Size. *Source: National Wood Owner Survey Database, USDA Forest Service Inventory and Analysis, 2008*

The private ownership of land in our society is often associated with personal wealth rather than with responsibility or opportunity for provision of ecological benefits or services for communities. Many of our tax and local service policies fail to value natural landscapes. They tend to treat forest woodlot management activities as a hobby, providing clear disincentives to maintaining large blocks of private forest land for timber, watershed or habitat values. This is especially true near developing areas where water quality, outdoor recreation and habitat linkages are needed the most. Vermont is fortunate to have the UVA tax program that allows managed forest land to be taxed at a rate comparable to the value of its use rather than the value if it were developed.

The forest products economy is primarily dependent on private forest land for its fiber supply. A constantly changing and aging landowner population and increasing subdivision of forested lands are current issues that affect wood availability. As woodlot parcels get subdivided, the resulting smaller parcels make it more difficult to profitably harvest timber on a parcel by parcel basis. As the landowner population changes, there

is an increasing number of owners who are not aware of the role that timber harvesting plays in forest stewardship.

Intergenerational transfer of forest land presents a particular challenge to both forest landowners and forest managers and planners. Without prior estate plans, properties transferred after the death of an owner are often taxed at high levels. Many people leave property to more than one heir, which spreads out the tax burden, but often forces the sale or subdivision of assets to achieve equity in transfer and to pay the taxes.

Even when an elderly forest landowner wishes to pass on an intact forest, it is difficult if the heir has no time for, interest in or does not live near the managed property. Most attorneys practicing estate law do not present clients with options regarding land protection unless it is specifically requested by the client. A study done in 2004 found that forest landowners aged 65 or older controlled 44% of the nation's forests. Nearly half of this forest was controlled by an owner 75 years of age or older (Butler & Leatherberry, 2004). In 1983, 25% of private woodland owners were under 45 years old, 53% were between the ages of 45 and 64, and 22% were older than 65. In 2008, 16% of landowners were under 45, 59% were between 45 and 64, and 25% were older than 65 (USDA Forest Service Forest Inventory and Analysis, Northern Research Station, 2008). Given the amount of forest land that may turn over in the next decade, lands controlled by older forest landowners are at the highest risk for development unless legal planning for transfer has been done in advance.

State Lands Management

The Vermont Agency of Natural Resources owns approximately 350,000 acres of land in 200 towns across Vermont with parcels ranging in size from several acres to several thousand acres. These lands are managed for a variety of conservation purposes including recreation, wildlife habitat, timber management and flood water flowage.

Lands owned by the Departments of Forests, Parks and Recreation and Fish and Wildlife are managed under the guidance of long-range management plans. The development of these comprehensive plans is based on multi-resource inventory data including an assessment of natural communities, wildlife habitat, timber, recreation and historic resources. The ANR Land Management Classification is applied to shape and communicate the implementation of management activities for the planning period. Each planning effort includes public outreach. Long-range management plans may address just a single state forest or wildlife management area, or may be several parcels combined into a management unit.

Timber and vegetation management contributes to the maintenance and enhancement of biodiversity; production of a variety of forest products at a sustainable level; improvement of forest health conditions; management of quality habitat; enhancement of scenic beauty; control of invasive exotic species; and the demonstration of sound forest management practices.

Regeneration of Vermont's forests generally occurs naturally as a result of the timber management process. As trees are removed and gaps created, new trees grow from on-site seed sources. Planting, while part of Vermont's early forest history, is not common practice following harvest and generally only occurs to meet very specific objectives (e.g. enhancement of sensitive natural communities, restoration of riparian buffers). Pilot projects to facilitate adaptation to climate change suggest that alternate forest regeneration methods may need to be considered in the future.

The Department of Forests, Parks and Recreation has sold personal road-side firewood lots on state forest lands since the 1970's. A limited number of firewood lots are made available by a lottery system in each region of the state. Demand fluctuates with the price of fuel. Over the past two years, the Division of Forests has been partnering with the Vermont Agency of Human Resources in a program referred to as the Wood Warms Initiative to supply firewood from state timber sales to low income Vermonters.

State lands are owned and managed to meet a variety of goals and objectives and are seldom managed to maximize any one goal. As such, timber growth exceeds harvest. It is expected that scheduled harvests from state lands will increase over the next few years as state budget constraints direct more utilization of forest receipts for management activities.

State land has supported an active timber management program for many years that has contributed to local, state and regional economies. Other activities occurring on state land also contribute economically including hiking, tourism, hunting, fishing, trapping, snowmobiling and cross-country skiing.

Federal Lands Management

Green Mountain National Forest

The Green Mountain National Forest (GMNF), established is 1932, encompasses more than 400,000 acres in southwestern and central Vermont, forming the largest contiguous public land area in the state. In 2006, the Forest Service completed the

Green Mountain Land and Resource Management Plan which describes the role of the GMNF in managing for multiple-use purposes. Although the Forest Service will continue to manage these lands for multiple-use purposes, they will strive to emphasize the following uses and interests seeking to provide benefits for people today, with an eye towards coming trends so as to maintain options and opportunities for future generations: conducting management activities in a manner that perpetuates an abundance of clean water and the maintenance of productive soils; assuring lands are well suited to trail-based activities in backcountry settings; enhancing wildlife and plant habitat conditions; focusing on producing high-quality, high-value forest products; actively contributing towards sustaining the character of Vermont's rural landscape, fostering vibrant local communities and economies; serving as a model of ecological and science-based forest stewardship; and playing an increasingly important educational role (Green Mountain Land and Resource Management Plan, 2006).

Activities that are guided by the 2006 Forest Plan have impacts to both state and private forest lands within the region. The traditional Forest Service role of managing the Green Mountain National Forest for multiple–use and other purposes compliments many of the stewardship goals created by the Department of Forests, Parks and Recreation for state and private forest land in Vermont.

The Department worked closely with the Green Mountain National Forest staff to support development of the 2006 Forest Plan and will continue to partner with the Forest Service with plan implementation by: actively participating in environmental assessments for management activities throughout the forest, cooperating with the Forest Service on land acquisition within the purchase boundary and occasionally assisting with management activities on the national forest land when mutually beneficial to both organizations.

Silvio O. Conte Fish and Wildlife Refuge

In 1991, Congress passed the Silvio O. Conte National Fish and Wildlife Refuge Act. The act authorized the U.S. Fish and Wildlife Service (FWS) to establish a national fish and wildlife refuge to protect the diversity and abundance of native species within the Connecticut River watershed. In 1997, Champion International Corporation announced that it would sell approximately 132,000 acres of land in Essex County, Vermont. A nonprofit conservation organization, The Conservation Fund, successfully bid on the property and subsequently passed it along to agencies and a timber company. Because the Nulhegan Basin was identified as a Special Focus Area for the Refuge, the FWS was offered ownership of 26,000 acres within the Basin. The purchase of this area by the

FWS in 1999 marked the establishment of the Nulhegan Basin Division of the Silvio O. Conte National Fish and Wildlife Refuge. The Vermont Agency of Natural Resources acquired about 22,000 acres adjacent to the Basin to form the West Mountain Wildlife Management Area. Essex Timber Company (a private timber company) purchased the remaining 84,000 acres that surrounds the federal and state properties, subject to protective easements that restrict future development and encourage sound and sustainable forestry practices. The combination of ownerships and easements on the 132,000 acres will provide long-term conservation of important wetland and upland wildlife habitats as well as preserve traditional uses of the land.

The Department of Forests, Parks and Recreation has worked as a partner with FWS on the Silvio O. Conte Refuge. The Department is interested in continuing to develop a working partnership through the Silvio O. Conte Comprehensive Conservation Plan that is presently being developed.

Marsh-Billings-Rockefeller National Historical Park

In 1992, the Marsh-Billings-Rockefeller National Historical Park was created by an act of Congress after being donated by Laurance and Mary Rockefeller. It is administered by National Park Service as a national historical park. The Rockefeller estate and 650 acres of forest land known as the Mount Tom Forest was the boyhood home of George Perkins Marsh, one of America's first conservationists and later home of Fredrick Billings, conservationist, railroad builder, philanthropist and pioneer in reforestation and scientific farm management.

Since its creation, the Park's educational projects and activities have enhanced and enriched public discussion about land and cultural stewardship in the region. The forest management plan prepared for the Mount Tom Forest and implemented by Park staff has demonstrated how commonly held public values are enhanced by forest stewardship. It also compliments the Division's vision of encouraging high quality stewardship of Vermont's privately-owned natural resources by managing forests for sustainable use, providing opportunities for compatible outdoor recreation, and furnishing natural resource information and education to the public.

Public Awareness and Technical Assistance

The core of Vermont's forest stewardship efforts for the past five decades has been the 'County Forester Program.' Arguably the best known state employees in our rural counties, the County Forester (CF) has always been the point of contact for cost-share

information, Use Value Appraisal tax advice/application, and assistance on a variety of forestry issues for landowners and consulting foresters. The CF is conveniently located within the region and available for field days and garden clubs, as well as landowner workshops and field inspections. They coordinate with state Fish and Wildlife biologists to provide landowner outreach on habitat management and conservation. Nearly all CF's have served as Tree Farm inspectors and all have some involvement in municipal forestry. The burgeoning responsibilities of Vermont's UVA program have in recent years limited CF's time for outreach, but they remain the principle support for Vermont's private and municipal forests. Other Division staff has strong outreach in specific program areas including urban and community forestry, tree diagnostic services, forest health monitoring, fire protection, wood utilization and watershed forestry.

Public awareness is critical in protecting forest health. Educational campaigns, such as 'Don't Move Firewood' and 'Buy Local,' help prevent the spread of invasive species. An informed public is also our primary early detection tool. All North American infestations of Asian longhorned beetle, and most of emerald ash borer locations, have been detected by members of the public. In Vermont, trained volunteers assist with surveys for hemlock woolly adelgid, invasive plants and other pests. Early detection allows for a broader range of management strategies. In Vermont, hemlock woolly adelgid has been introduced at least four times on live nursery trees. None of these introductions resulted in an established infestation, because, in each case, the insects were detected before they had spread.

Our state urban and community forestry program has a strong outreach component using such tools as an e-newsletter and a listserv. Since much of the planting and care of municipal trees and forests falls on the shoulders of community volunteers, the program has instituted a volunteer training program called Stewardship of the Urban Landscape (SOUL). The program's goal is to educate citizens about the importance of trees and their care, and build a cadre of tree steward leaders in the state who bring to their community the skills needed to manage their forest resources. The program uses innovative technology such as interactive television and an online blackboard classroom to increase participation and engagement. Enrollment is up over 400% since 2005.

The Division makes use of the holiday of Arbor Day to perpetuate a message of the importance of trees. Each year, over 6,000 of Vermont's youth participate in one of the various Arbor Day offerings from receiving a free tree seedling to plant to participating in a fifth grade poster contest about urban forests.

Effective delivery of information and education is linked to accessibility and visibility. An interactive web-based program called "ACORN" was developed at University of Massachusetts to help landowners map their property and keep in touch with local experts, programs and funding opportunities. This project included two counties in southern Vermont and has proven to be an efficient way to deliver a suite of information, particularly to out-of-state landowners. Other avenues to market forest stewardship include a new initiative offering direct peer-to-peer contacts for new landowners; mailings to landowners enrolled in UVA for short, direct messages; television and radio media, limited mostly to public service announcements and events; and print media which has been very successful with our partners such as The Vermont Woodland Association's newsletter and Northern Woodlands Magazine with a circulation of over 15,000 throughout New England.

The most effective tools for outreach are technical service providers who can give landowners advice, training and referrals. Outside of state and federal personnel, consulting foresters, private professionals who earn their living managing forest land for woodland owners, offer a full range of forest and wildlife management services, including inventory, planning, design and oversight of management operations. They frequently represent landowners in timber sales by selecting and marketing timber and other forest products, and overseeing harvests and restoration. They charge for their services, either on a per diem basis or as a percentage of the gross income received from wood product sales which they oversee.

Town Forest Fire Warden System

For over 100 years, the Town Forest Fire Warden system in Vermont has been effective in fire suppression and fire prevention. Town forest fire wardens regulate open burning in their towns through issuing "Permits to Kindle Fire," educating the town residents about safe open burning practices, and maintaining relationships with their local fire departments. Town forest fire wardens are the local points of contact for questions and concerns about open burning, enforcing forest fire laws and promoting the safe and reasonable use of fire by the residents of their towns.

The Division of Forests provides annual training to the Town Forest Fire Wardens to keep them up-to-date on the latest methods, technologies and trends in wildland fire. Town forest fire wardens are equipped by the state with all the materials needed to promote fire prevention and safe burning. By law, they are in charge of wildland fire suppression, and often call upon the state for technical assistance and specialized equipment.

Public Participation

Participation of the public in planning and managing Vermont's forests comes at many different levels. State, federal and municipal governments all have well-developed avenues for notifying and collecting input from citizens on management plans, strategies and directions.

The Division of Forests has two standing advisory committees; the Vermont Urban and Community Forestry Council and the Vermont Forest Stewardship Committee (VFSC). These two groups provide advice and guidance on program development, implementation and accomplishments. The VFSC serves as the ranking body for the Forest Legacy Program, and were engaged during the development and review of the state assessment and resource strategies.

Public Involvement on Public Lands Management

State Lands

Public participation and input is an important component of the long-range management planning process for state land. Planning and state land parcel information is made available to the public in an understandable format at advertised meetings held at convenient times and locations. Public comment is taken as advice and the Agency of Natural Resources makes every effort to include suggestions that are compatible with the ANR and its departments' missions; compatible with ANR lands management principles and goals, and which are fiscally realistic.

The level of public process varies dependent upon several factors including the significance of the resources; legal complexities; potential for user conflicts; parcel size; and degree to which any proposed management results in significant land use change. The public is notified at the beginning of the planning process through a variety of ways (e.g. press releases, Department website, and direct mailings). The number of public meetings scheduled and the degree to which focus groups or other means to gather public comment are used is dependent upon the complexity of the parcel and the issues raised during the planning process. Meeting format also varies and can include open houses and presentations followed by questions and answers. A comment period is extended beyond the public meeting to give ample time for response. In some cases, a summary of comments is compiled and included in the final plan.

Municipal Lands

Vermont has a community governance system based on towns. Each Vermont town that is incorporated has a Selectboard of duly elected citizens with various other town committees and boards that make recommendations on aspects of town business. Many communities have a Conservation Commission, Tree Board or Planning Commission that oversees local ordinances related to street trees and/or the acquisition and management of town forests. There are specific rules for "warning" citizens of various rule changes, public meetings or plan activities. Each town holds a town-wide meeting in March at which time issues are voted on by the populace. There are also opportunities for special meetings on single issues. Citizens can participate at designated meetings or can collect signatures to call meetings. On many issues, citizens can meet directly with the Selectboard to discuss concerns or present petitions. Communities vary in how they engage the public on issues related to forest planning on municipal lands, but Selectboards are contacted by the state about planning and management issues on state-owned lands in their towns and are important stakeholders. Engaging citizens in land use decisions at the local level promotes the understanding of community benefits and a stewardship ethic. By statute, municipalities can request state assistance in the management of the land they own. A significant number of town, municipal and community forests that have active management use the services of the Division's County Foresters.

Federal Lands - Green Mountain National Forest

Public Involvement is important and required in the development of both a Forest Plan and the projects that will implement that Forest Plan. The National Forest Management Act requires the Forest Service to establish procedures to give the federal, state, and local governments and the public adequate notice and an opportunity to comment upon the formulation of Forest Plans. The National Environmental Policy Act regulations (40 CFR 1500.2(d)) require federal agencies to "encourage and facilitate public involvement in decisions which affect the quality of the human environment. During the development of the 2006 GMNF Forest Plan, the GMNF staff conducted extensive public involvement. Over 70 meetings were held to provide other agencies, municipalities, stakeholders and individuals opportunities to be involved with the development of the Forest Plan at all stages. The meetings were designed to provide information to the public on existing conditions of resources as well as to give the public an opportunity to provide input on the future management of

the GMNF. All the information available at public meetings was also made available on the GMNF website and the public was encouraged to provide comments via email or other means throughout the revision process. Public involvement continues with the development of site specific projects designed to implement the 2006 Forest Plan. Projects are designed in collaboration with stakeholders, other state and federal agencies, and interested citizens most often from the communities where the projects will occur.

The actual on-the ground implementation of many of the GMNF's projects also depends on public participation in the form of partnerships. Numerous organizations work with GMNF staff to maintain roads, trails and historic sites, conduct inventories and research, and create wildlife habitats. This level of public involvement is crucial in providing services and opportunities for public enjoyment on the GMNF.

Forest Certification

Forest certification is another tool to enhance sustainable use and promote exemplary management. There are three main forest certification programs within Vermont: Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) and Tree Farm (ATFS). All are third party audit systems that use different standards. In addition to forest certification, all three claim to provide or have access to third party chain-of-custody certification which is necessary for finished products to carry indication of certification.

Forest certification efforts are limited in Vermont, in part by the lack of large forest properties. Certification entails an initial entry cost as well as periodic audit costs for the landowner. Larger properties are better able to bear these costs because of the greater likelihood of some level of annual harvesting. A legislatively-mandated study investigating the feasibility of third party certification for state land concluded that lack of financial resources precluded the ability to pursue state land certification at this time.

Chain-of-custody certification is equally challenging by the relative lack of certified forest products and what has been a very slow growth in demand for certified wood products. In Vermont, four sawmills and ten wood product manufacturing companies currently participate in chain-of-custody protocols with one or more of the certification systems. About 50 percent of wood product businesses use at least some volume of certified raw material, including those that are chain-of-custody certified. All report that

a scarcity of certified wood supply and/or certified wood demand represents a problem. However, wood product manufacturers report that as demand for wood products recovers from the current depressed state, they expect that certification will play a much larger role in consumer preference. 'Buy Local' is a consumer interest that is expanding beyond food and agricultural products and into the forest economy.

Desired Future Condition 5: *Legal, Institutional and Economic Framework*

Vermont has a legal, institutional and economic framework in place for forest conservation and sustainability

To uphold the views and values society holds towards Vermont's forests, a legal, institutional and economic framework needs to be in place to support the conservation and sustainable management of our forests. This recognizes that conditions and processes beyond the forest play a large role. Policies and guidelines need an enabling institutional environment for their formulation and implementation. The legislation provides the regulatory and fiscal instruments needed to achieve policy objectives. Institutions also provide the human and technical capacities needed to implement activities and programs for sustainable, healthy forests. Evaluation of these policy and institutional frameworks is a necessary component for the assessment of forest sustainability.

Vermont has long history of an open and collaborative governmental structure. Cooperation among forest landowners, the public and government fosters confidence and ongoing, productive involvement by all of society in developing and implementing public policy.

To fulfill our mission, the Division of Forests will continue to work, as we have for more than a century, for the wise management of Vermont's forests. While periodic internal assessment and reorganizations will always be necessary, increased efficiencies can no longer compensate for continual reductions in staff and funding. A major commitment to our programs, through the provision of adequate funding, must be realized.

The Department of Forests, Parks and Recreation has broad authorities granted for assessments, policy development and management. Found primarily in Title 10, several different chapters address powers and authorities. We have statutory authority to carry out an assessment of the state's forest resources and to develop a plan to guide the Department in fulfilling program responsibilities. The Forest Resources Plan is one source for reporting that assessment and meets the intent of V.S.A. Title 10, Chapter 73, Section 2225, which authorized the Department to: "*carry out a detailed inventory and analysis of the forest resource," which "thereafter shall be the basis for planning programs and their administration by the Department for the conservation, management and development of Vermont's forest resources."*

In 1951, the Vermont Legislature enacted into law a policy that states: *"the forests, timberlands, woodlands and soil and recreational resources of the state are hereby declared to be in the public interest* (Title 10, Chapter 83, Section 2601)." Continuing in Section 2601; *"It is the policy of the state to encourage economic management of its forests and woodlands, to maintain, conserve and improve its soil resources and to control forest pests to the end that forest benefits, including maple sugar production, are preserved for its people, floods and soil erosion are alleviated, hazards of forest fires are lessened, its natural beauty is preserved, its wildlife protected, the development of its recreational interest is encouraged, the fertility and productivity of its soil are maintained, the impairment of its dams and reservoirs is prevented, its tax base is protected and the health, safety and general welfare of its people are sustained and promoted."*

Sub-section (b) of Section 2601 charges the Department to: *"implement the policies of this chapter by assisting forest landowners and lumber operators in the cutting and marketing of forest growth, encouraging cooperation between forest owners, lumber operators and the State of Vermont in the practice of conservation and management of forest lands, managing, promoting and protecting the multiple use of publicly-owned forest and parks lands; planning, constructing, developing, operating and maintaining a system of state parks…"*

Forestry Division Staff

The Division of Forests greatest asset has always been its staff. A professional and dedicated workforce supported by management is critical in a climate of declining revenues. From a peak in the 1980's of 80 employees, the Division now has 54 full-time employees. According to the 'Fiscal Year 2009 State of Vermont Workforce Report,' the Department of Forests, Parks and Recreation (FPR) has the highest average length of service (18.7 years). The average age for FPR is 49.2 years old. This ranks' 7th in Vermont State Government at the departmental level. FPR currently has 19% of its classified workforce eligible for retirement; 24 employees have retired since 2005. In five years, the number of FPR employees eligible for retirement will nearly double to 40%. The loss of institutional memory due to retirements is a concern. Maintaining the Division's commitment of employees and teamwork is essential to meeting future challenges.

Economic Framework

The Division's annual budget is currently 5.4 million dollars which includes: 67% general funds, 21% federal funds (excluding Forest Legacy Program acquisitions), 9% special

funds and 3% inter-departmental transfers. The percent of the Division's budget comprised of federal funds has shifted over the past eight years from a high of 26.5% to a low of 21%. These shifts are a result of variable revenues from state and federal sources. The general fund contribution to the Division's budget has been declining over the past three fiscal years for an overall decrease of 8%.

Personnel costs make up roughly 95% of expenditures. The second largest expenditure is grants. These range from small, one-time expenditures to larger on-going commitments. As a result, decreasing revenues have led to the inability to backfill after retirement and reduction of some grant amounts. We have attempted to increase revenues through some fee-for-service work to other public agencies and retention of revenues generated from the sale of forest products from state land. Additional revenue enhancements are needed. The Strategies Matrix on page 32 lists the financial resources needed to accomplish the goals of this plan.

Inter-Agency/Government Cooperation

The Division of Forests works closely with many departments within state government as well as several federal agencies. An integrated approach, drawing upon many disciplines, guides our programs and supports other efforts on behalf of Vermont's forests and our relationships with them. The specific departments/agencies the Division works with are listed under partners on page 111.

Use Value Appraisal

The cornerstone for the Use Value Appraisal (UVA) program is the requirement that each parcel submit a management plan. The management plan must meet acceptable silvicultural standards recommended by the Division of Forests. Properties are periodically inspected for compliance and management plans are updated every 10 years. If a landowner decides to leave the program or is found in non-compliance, they pay a penalty based on a percentage of fair market value of the 'developed' portion. Enrolling in UVA places a lien on the property that stays with the land if it is sold or changes hands.

Vermont's county foresters are the primary contact with forest landowners and landowner organizations. Without the expertise of county foresters to guide landowners towards natural resource professionals, many would be limited in access to management assistance. These efforts compliment the purpose of the Forest Stewardship Program and are administered in unison.

Vermont Association of Planning and Development (VAPDA), through individual Regional Planning Commissions, provide an assessment of forest resources and strategies to maintain working forest landscapes and protection of significant resources, and are included in regional plans. Regional plans could serve as landscape-scale plans for Vermont's Forest Stewardship Program and be referenced to in landowner UVA plans.

Cost-Share Opportunities

Private forest landowners often rely on federal and state funding. Cost-share programs administered through the Natural Resource Conservation Service (NRCS) are important to augment management costs for non-commercial activities. The Division of Forests participates on the NRCS State Technical Committee, and the Director of Forests and State Conservationist are collaborating on several landscape scale projects. Most notably is the 'Keeping Forests as Forests' initiative within New England and supported by the NE Governors. Funding through Environmental Quality Incentives Program (EQIP) and Wildlife Habitat Enhancement Program (WHIP) cost-share programs should be maintained and enhanced, and efforts made to engage Vermont's consulting foresters in promoting cost-share options for forest landowners.

Regulatory Protection of Forest Water Resources

There are various state rules and regulations aimed at protecting the function that forests provide for water quality, reducing the risk of nonpoint source (NPS) pollution associated with logging, maintaining physical functions of streams and protecting wetlands, aquatic systems and riparian habitats.

Acceptable Management Practices

In 1986, the Vermont Legislature passed amendments to Vermont's Water Quality Statutes Title 10 V.S.A., Chapter 47: Water Pollution Control. The amendments declared that "it is the policy of the state to seek over the long-term to upgrade the quality of waters and to reduce existing risks to water quality." The revised state law requires permits for discharges of "any waste, substance or material into the waters of the state." However, individual permits are not required for any discharges that inadvertently result from logging operations if responsible management practices are followed to protect water quality. "Acceptable Management Practices (AMP's) For Maintaining Water Quality on Logging Jobs in Vermont" were developed and adopted as rules to

Vermont's water quality statutes and became effective on August 15, 1987. The AMP's are intended to prevent any mud, petroleum products and woody debris (logging slash) from entering waters of the state.

Two-hundred sixty-one AMP cases were investigated by the Division of Forests' staff from 1999 through 2009 and revealed evidence of a discharge. These cases have been examined in detail to pinpoint sources of discharges on timber harvesting operations. The results are depicted in Figure 13 and shows that the majority of discharges are associated with stream crossings, practices associated with working within the buffer and skid trails. This is important information for tailoring logger training and education programs in Vermont.

Figure 13. AMP Cases, Source of Discharge (%). *Source: Vermont Department of Forests, Parks and Recreation, Division of Forests, 2009*

Since adoption of the AMPs, the Division has worked with representatives from the Vermont forest industry and the Department of Environmental Conservation Compliance and Enforcement Division to reduce the number and severity of water quality violations resulting from timber harvesting operations. There continues to be a high level of cooperation and voluntary compliance among loggers and landowners to bring operations into compliance with Vermont's water quality statutes. Logger training, through Vermont's Logger Education to

Advance Professionalism (LEAP) Program, has provided Forest Water Quality and AMP workshops on a regular basis to assist loggers.

There is no apparent upward or downward trend in the number of AMP cases investigated. However, anecdotal information from staff investigating AMP cases indicates that water quality violations are becoming less severe. AMP reports submitted by FPR staff for 1999 to present indicate that the number of cases investigated ranged from a low of 29 during 2007 to a high of 49 during 2000 and 2008. The numbers vary due to many variables such as amount and distribution of annual rainfall, number and timing of timber harvesting operations, market conditions.

Act 250

Act 250, Vermont's land use law, was enacted in 1970 and is now forty years old. Recognized nationally as a landmark land use regulation, ten criteria were developed to minimize environmental impact from development. Four of those criteria address the protection of soil and water resources: (1) Water and Air Pollution, (2) Water Supply, (3) Impact on Existing Water Supplies and (4) Soil Erosion. Headwaters are defined and protected under this state statute. Headwaters are predominantly forested and can generally be considered as pristine. Because headwater streams have a significant influence on downstream river processes, it's important to direct protection and conservation efforts to maintain and enhance forest cover in these watersheds, (Map 36: Land Classification of Vermont Headwaters).

Wetland Rules

In 1986, the Vermont Legislature passed the Vermont Wetlands Act, which mandated the adoption of rules that would identify and protect significant wetlands and their associated buffers. In February of 1990, the Vermont Wetland Rules became effective. Under these rules, silvicultural activities are allowed without prior review. However, there are certain conditions that apply to timber harvesting operations that occur in mapped wetlands. Violations of Vermont's Wetland Rules from timber harvesting activities are few. Logger training, through Vermont's Logger Education to Advance Professionalism (LEAP) Program, has provided Forest Water Quality and Wetlands workshops on a regular basis to help loggers comply with Vermont's Wetland Rules (Water Resources Board, 2001).

Stream Alteration Permits

A review and permit is required for any stream crossing (culverts, bridges or at-grade fords) when the drainage area above the crossing encompasses a minimum of ten square miles; and the project requires fill or earthwork construction involving ten cubic yards or more to construct and/or maintain the crossing.

A review and stream crossing approval is also required for permanent stream crossing structures (excludes at-grade fords) where the drainage area is greater than one square mile but less than ten square miles (Vermont Department of Environmental Conservation 401 Certification of the amended Section 404 Vermont General Permit GP#58).

Quarantines

The Vermont Agency of Agriculture, the USDA Animal and Plant Health Service and the Division of Forests cooperate on emerging forest pest needs and the necessity of imposing quarantines. Quarantines can be established at the federal or state level and are meant to restrict the movement, sale and distribution of designated plant pests and regulated articles from infested to uninfested areas. Vermont's list of quarantined forest pests is included under Title 6, Chapter 84, §1034. Current forest-related quarantines include four state regulated forest pests: hemlock woolly adelgid, pine shoot beetle, Scleroderris canker and noxious weeds. Three federally regulated pests that have not been found to occur in Vermont are: Asian longhorned beetle, sudden oak death and the emerald ash borer. Two additional federally regulated pests are present in Vermont: gypsy moth and Japanese beetle. Details of these quarantines are posted on the Agency of Agriculture's website: www.vermontagriculture.com/ARMES/plantindustry/PlantandPestQuarantines.html. A recently developed Vermont Invasive Forest Pest Action Plan indentifies roles and responsibilities of the Agency of Agriculture, the Department of Forest, Parks and Recreation and the University of Vermont in forest pest control.

Heavy Cut Law

In 1997, the Vermont Legislature passed H.536 (Act 15), known as Vermont's "Heavy Cut" law. This law was enacted to monitor and regulate heavy cutting/clear-cutting being done in the state. Title 10, Chapter 83, §2625 states that a "heavy cut" is a harvest leaving a residual stocking level of acceptable growing stock below the C-line as defined by the United States Department of Agriculture, US Forest Service silvicultural stocking guides for the applicable timber type. This act requires landowners who intend to

conduct a “heavy cut” of 40 acres or more, on land owned or controlled by the landowner, to file a notice of intent to cut.

The act exempts the following: (1) heavy cuts intended to carry out agricultural conversions that will result in land in agricultural production within five years; (2) heavy cuts to carry out a conversion regulated by Act 250 or the public service board; and (3) heavy cuts consistent with an approved forest management plan under the Use Value Appraisal program, consistent with an approved chip harvesting plan or consistent with any other plan approved under other department rules. Results to date of applications approved and acreage approved for heavy cutting are depicted in Figure 14.

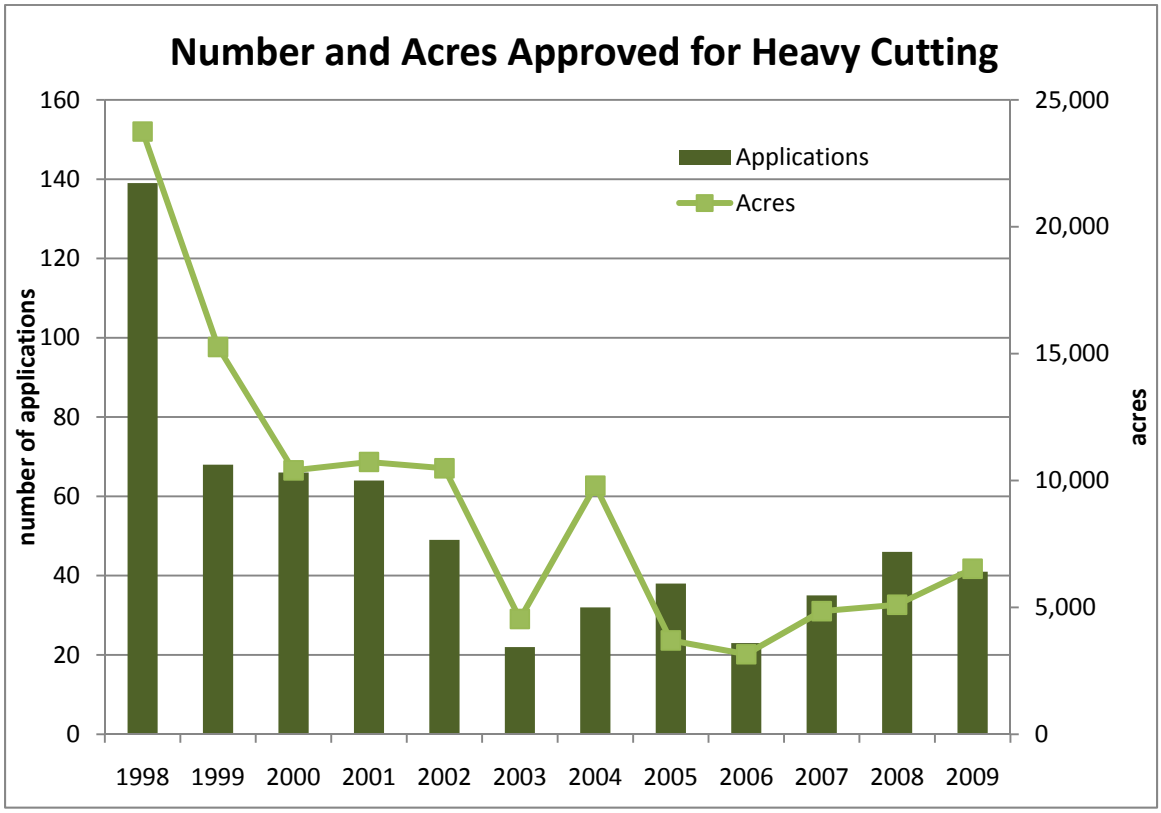

Figure 14. Number and Acres Approved for Heavy Cutting. *Source: Vermont Department of Forests, Parks and Recreation, Division of Forests, 2009*

Shortly after the law went into effect, the state experienced a severe ice-storm in 1998 that caused extensive damage to some areas of Vermont’s forests. Salvage operations were conducted for the next several years in response to the damage inflicted. Much of the approved heavy cutting that occurred from 1998 through 2002 reflects timber harvesting operations designed for salvaging damaged forest stands. Since then, activity has leveled off. Most of the approved heavy cuts are exemptions where the landowner

has a forest management plan in effect that has been approved by the Department of Forests, Parks and Recreation.

Forest Practices

Interest in a statewide forest practices act circulate on an infrequent basis. Current concerns on forest sustainability, particularly related to potential increase in biomass harvesting, has lead to some interest in developing procurement standards. Voluntary compliance with acceptable management practices, logger and landowner education and enforcement of current regulations continue to serve the state well.

Partnerships

Vermont landowners have access to a variety of other tools and resources through partner organizations. Key organizations in Vermont that work cooperatively with the Division of Forests are included here and listed in Appendix A: Planning Process Summary if they were involved in the development of the plan. Initials in parenthesis after partners names, indicates key to organizations listed as partners in the Strategies Matrix starting on page 32.

Agency of Agriculture (AA): Administers programs and develops policies and procedures for regulating and managing the state's agricultural land, products and livestock.

Agency of Commerce (AC): An MOA with the Agency helps the Division coordinate economic development and marketing within the forest products sector and the rest of Vermont's manufacturing sectors.

American Society of Landscape Architects – Vermont Chapter (ASLA)*:* Professional association representing landscape architects. They promote the profession and advance the practice through advocacy, education, communication and fellowship. In the 2010 legislative session, licensure of landscape architects was enacted in the state.

Associated Industries of Vermont (AIV): The Forestry Policy Task Force group of this organization addresses statewide policies affecting the industry and also serves as the state coordinator for the national Sustainable Forestry Initiative (SFI).

Audubon Vermont (AV): Affiliated with National Audubon Society, they are involved in environmental education, research and advocacy. With the assistance of a Forest Service Redesign grant, they have an initiative called 'Foresters for the Birds.' The program provides education and technical assistance to manage forest lands for bird habitats. The program is proving to be an excellent mechanism to bring forest landowners with an interest in birds into being active forest stewards.

***Center for Northern Woodlands Education*:** A nonprofit organization that uses media to encourage a culture of stewardship. A high quality quarterly subscription magazine, 'Northern Woodlands,' includes articles related to programs and technical assistance, website and other publications on forest and wildlife issues.

Connecticut River Joint Commission: Established in Vermont, New Hampshire and Massachusetts in the 1980's. The commission advises the three Governors in developing policies to guide growth and development across the Connecticut River.

Conservation Commissions: Local municipal commissions work to sustain their important natural and cultural resources. Statewide umbrella organization is the Association of Vermont Conservation Commission. They offer educational, networking and financial support to local commissions.

Department of Fish and Wildlife (FW): Responsible for managing and protecting the state's fish and wildlife resources through protecting habitats, implementing species management plans, educating the public, performing research, enforcing fish and wildlife regulations, and managing wildlife management areas.

Land Trusts (LT): Vermont is fortunate to have non-profit land trusts at the forefront of developing stewardship programs that incorporate landowner education into conservation easement monitoring. The largest of these is the Vermont Land Trust. All such organizations work to identify and protect important agricultural, forest and habitat lands in Vermont; and provide outreach to landowners on land protection, estate planning tools and easements.

Logger Education to Advance Professionalism: Supported by the Division of Forests, UVM Extension and the forest products industry, the program provides education on forest ecology, forest management systems and training in safety and techniques for tree felling and logging.

Marsh-Billings-Rockefeller National Historical Park (US): Created in 1992 after being donated by Laurence and Mary Rockefeller, the 650 acre park is an excellent example on long-term forest stewardship.

Natural Resource Conservation Districts (NRCD): A statewide network of local units of government responsible for helping landowners with conservation practices and offer workshops, projects and demonstrations on a variety of natural resource topics. NRCD's often make trees and wildlife shrubs available for planting. The Bennington County NRCD sponsors the "Sustainable Forest Consortium" providing educational programs on forest topics**.**

Northern VT and George Aiken Resource Conservation and Development Councils (RCD): Affiliated with NRCS, they sponsor the "Forestry Letter Series" in some Vermont counties, provide outreach to youth on natural resources, and outreach on specific forestry topics, including watershed protection. They also partner with the Division on the Portable Skidder Bridge Program.

Recreation Groups (RG): Numerous recreational organizations, both statewide and regional, coordinate recreation opportunities and maintain miles of recreational trails throughout the state. Statewide organizations include: Catamount Trail Association (CTA), Green Mountain Club (GMC), Vermont All Terrain Vehicle Sportsman Association (VASA), Vermont Association of Snow Travelers (VAST) and Vermont Mountain Bike Association (VMBA).

Silvio O. Conte National Fish & Wildlife Refuge (US): Established in 1991 to promote conservation of the abundance and diversity of native plants and animals, and their habitats on 7.2 million acres in the Connecticut River Watershed in Connecticut, Massachusetts, Vermont and New Hampshire. The US Fish and Wildlife Agency owns 26,000 acres in the Nulhegan Basin in northeastern VT.

Society of American Foresters (SAF)**:** Educational, outreach and policy services to professional foresters in Vermont with limited outreach to landowners. The

Green Mountain Division serves Vermont and represents many of the practicing foresters in the state. They sponsor continuing education credits and serve as Vermont's only forester certification effort.

The Nature Conservancy (TNC): In addition to preserving natural communities and features through acquisition and conservation, TNC provides educational and outreach efforts on the natural world. Specific interests in Vermont include invasive plants.

Third Party Certifiers: There are a number of national third party certifiers of forest sustainability operating in Vermont. Sustainable Forestry Initiative (SFI) is an industry-based program, while Forest Sustainability Council (SFC) is accepted and sponsored by a broad array of environmental organizations including Smartwood and Rain Forest Alliance. All have forest management certification and chain-of-custody programs.

Tree Farm: A program of the American Forest Foundation with chapters in every state, Tree Farm promotes forest management on private forest land. TF also has a third party certification program. In Vermont, the program is managed by Vermont Woodland Association.

University of Vermont, Cooperative Extension (UVM): Provides University of Vermont-based information and can draw on the expertise of the Rubenstein School of the Environment and Natural Resources. Extension's Natural Resources branch offers periodic workshops, short courses and produces a variety of educational publications on forest management, maple, and urban and community forestry.

US Department of Interior – Fish and Wildlife Service (US): Provides technical expertise in fish and wildlife conservation and management, enhancing interagency cooperation and partnerships between federal, state and local partners, and manages the Silvio O. Conti and Missisquoi National Wildlife Refuges.

USDA – Farm Services Agency: Provides cost-sharing to primarily agriculture producers for such programs as soil conservation and water quality improvements. The Conservation Reserves Enhancement Program (CREP) and

Biomass Crop assistance Program provide opportunities toward forestry interests.

USDA – Forest Service (NASPF, USFS): Comprised of three separate and distinct units. Research and Development provides valuable resource assessments through Forest Inventory and Analysis (FIA), as well as academic and applied research in a variety of forestry fields. State and Private Forestry provides technical assistance to landowners and resource managers, primarily through partnering with state forestry agencies, to help sustain the nation's forests and communities. Finally, the National Forest System manages almost 200 million acres of forests and grasslands. Within Vermont, the over 400,000 acre Green Mountain National Forest is managed out of offices in Rutland, Manchester, Rochester and Middlebury.

***USDA - Natural Resource Conservation Service (NRCS)*:** Once thought of as only supporting farmers, NRCS offers a variety of financial incentives to woodland owners who are engaged in conservation activities. Some programs offer annual payments for conservation use, others offer one-time, up-front payments for conservation easements, and others fund the cost to implement activities prescribed in forest management plans. Environmental Quality Incentive Program (EQIP) and Wildlife Habitat Incentive Program (WHIP) are two cost-share programs of value to Vermont forest landowners. The State Forester serves on the NRCS Technical Team which oversees cost-share programs, while a State Conservationist also participants on the Vermont Forest Stewardship Committee, thus ensuring coordination between these two agencies.

Vermont Association of Planning and Development (VAPDA): Regional Planning Commissions provide land-use planning technical assistance and guidance to local municipalities.

Vermont Coverts: Member organization that offers training and peer support on wildlife management techniques on private lands.

Vermont Family Forests: A nonprofit organization that promotes and educates about ecological community-based forestry practices.

Vermont Forest Products Association (FPA): Member association representing the full array of the forest products industry – loggers, truckers, foresters,

sawmill, and secondary manufacturers. Association advocates for the forest products industries and sponsors member training and educational programs.

Vermont Natural Resource Council (VNRC): A private nonprofit environmental education and advocacy organization, working to promote the wise use of Vermont's natural resources. They are engaged in lobbying, research and educational work on a variety of issues including forestry.

Vermont Nursery and Landscape Association (VNLA): Professional organization for the horticultural industry in Vermont. They support Vermont's green industry professionals through programming and certification, and promoting greater public awareness of green industry products and services in the state.

Vermont Wood Manufacturers Association (VWMA): Represents nearly 120 primary and secondary processors and related businesses statewide. They work to support the industry in Vermont and promote its long-term viability by expanding members' presence in the marketplace, ensuring a sustainable supply of raw materials, increasing workforce skill and acting as responsible employers and community members.

Vermont Woodlands Association (VWA)**:** Member organization that provides advocacy, training and peer support for landowners and foresters, regular newsletters and updates on legislation. They administer Vermont's Tree Farm Program and Association of Consulting Foresters. Tree Farm offers third party certification for members.

Watershed Organizations (WO)**:** Vermont has over a dozen watershed associations, some of which participate in projects related to forest resources.

Woodland Owners Association: Member organization for Windham County landowners and managers offering educational workshops, a newsletter, peer contacts and referrals.