

DESIRED FUTURE CONDITION: FOREST PRODUCTS AND ECOSYSTEM SERVICES

Maintain and enhance forest contribution to ecosystem services

OVERVIEW

Forests provide Vermonters with enormous benefits and a range of critical services and goods. A thriving forest economy, functioning natural systems, and Vermont's quality of life rely on maintaining healthy forests across Vermont's landscape. Forests provide a range of benefits including water supply and water quality protection, flood control and protection, wildlife habitat and biodiversity, clean air and CO₂ sequestration, and outdoor recreation and scenic beauty, all known as ecosystem services. These valuable services are often underappreciated because they are not always measured in economic terms.

More recognizable are the materials we and Vermont's economy depend on including timber, veneer, pulpwood, firewood, chips, and pellets, which can be quantified in dollars and jobs. Vermont's working landscape, which supports a forest products industry estimated to generate over \$1 billion annually in the state, is an important part of our rural economy that helps private forest landowners cover ownership costs and subsidizes conservation practices on public lands.

As we enter the 21st century, Vermont's forests have the potential to provide an abundance of economic, ecological, and social benefits into the future. Decisions made and actions taken today will influence Vermont's forests and forest values for years to come.

ASSESSMENT

ASSESSMENT: FOREST 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 are sold and processed all over the northeastern US and eastern Canada. Vermont logs, lumber, and finished wood products are sold around the world.

Vermont's forest-based businesses are an especially important part of the state's rural economy. The forest-products industry contributes \$832 million in sales to the state's economy annually and provides direct employment

for about 6,100 people. However, these figures do not account for the cumulative impact the industry has on other parts of Vermont's economy. Economic models used to account for this multiplier estimate that forest-based manufacturing, including Christmas trees and maple syrup, contributes an estimated 10,555 jobs and \$1.4 billion in economic output.²⁹

Vermont is home to an impressive range of wood product manufacturers and craftspeople. Businesses engaged in furniture making, millwork and moldings, turnings, and similar products employ nearly 1,600 Vermont workers. The payroll in this sector was about \$49 million annually in 2011, having declined from a peak of \$82 million in 2000. Vermont's annual economic output in the form of sales or value of shipments for the secondary wood products sector was an approximate \$143 million in 2011.

Vermont faces challenges related to the wood products industry. Across the northern region of the US, declines in the number of forest product manufacturers started in 2000 and continued at a steep pace following the downturn in the housing market around 2006. A similar pattern is true in Vermont, with a rapid reduction in the number of sawmills operating in the state since 1990.

Low-grade forest products market sectors are also experiencing contractions. Since Vermont does not have any pulp mills, foresters, loggers, and landowners rely on mills in adjacent states and Canada to market their pulpwood. Several pulp mills in Maine have recently closed or reduced production levels, further limiting opportunities for marketing low-grade wood. Low-grade wood consumption in Maine alone is down over 4 million tons in the last three years.

As the number of primary processors declines, there is a point at which the number becomes too small to adequately provide the effective market diversity that foresters and landowners require to sell forest products.

Helping to maintain the working forested landscape and a vibrant forest-based economy is the primary goal of FPR's Forest Product Utilization and Markets Program. Vermont's forest-based economy supports employment and provides forest landowners with solid financial returns through planned timber harvesting while promoting value-added manufacturing and tourism.

ASSESSMENT: WOOD ENERGY

Wood plays a significant role in Vermont's energy portfolio. During the 2014-2015 heating season, an estimated 39% of Vermont households (96,951) heat-- at least in part-- with firewood. Vermont families burned an estimated 347,530 cords of wood in 2014-2015, an increase of 33,530 cords (10%) from the estimated 314,000 cords used

²⁹ The Economic Importance of Vermont's Forest Based Economy 2013, North East State Foresters Association.
fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Vermont_Forests/Library/NEFA13_Econ_Importance_VT_final_web_Jan29.pdf

during 2007-2008. More than 12% of households heat with wood pellets, representing an increase of 20% in the number of households burning wood over the previous survey (2007-2008), when an estimated 80,744 households used wood. Usage of wood for space heat as opposed to household heat had been steadily declining from a high of 48% (1985-1986) at the time of the 1997-1998 survey.

More than 100 institutional facilities use wood chips or pellets for heating, and this number is rapidly growing. Vermont is a leader in heating schools and institutional facilities with wood chips; more than one-third of Vermont children attend a school heated by wood. Wood chips also fuel two large wood-fired electric power plants, seven institutional or public district heating systems, and numerous smaller commercial or public facilities and multi-family affordable housing projects.

Wood energy is also an important economic driver for Vermont. The Vermont Clean Energy, 2015 Industry Report,³⁰ estimates that 1,400 Vermonters work in the “woody and non-woody biomass” sector, and the Economic Importance of Vermont’s Forest-Based Economy³¹ estimates that the industry produces roughly \$60 million in the value of products manufactured. Sixty-nine Vermont schools have converted to wood-chip and wood pellet heating since the mid-1980’s. It is estimated in 2016 that these wood heating systems are displacing over 2,000,000 gallons of heating oil annually saving schools millions of dollars in heating costs. Most importantly, the money schools spend on wood fuel is paid to local businesses, returning the funds back into the local economy to support local loggers, truckers, and landowners.

FPR supports the adoption of ‘modern wood heating’ which encourages the use of highly efficient, clean burning and low emitting technology while recognizing that safeguarding long-term forest health and productivity is critical to ensure that wood fuel is renewable and sustainable. FPR supports using locally harvested and processed wood fuel to support local economies, minimize the threat of introducing invasive forest pests, and provide markets for the products of forest management.

The recently completed Comprehensive Energy Plan 2016 (CEP)³² builds on the state’s goal established in 2011 to meet 90% of Vermont’s energy needs from renewable sources by 2050. One fifth of the energy used to heat Vermont’s buildings and provide process heat³³ in industrial applications comes today from renewable sources,

³⁰ Vermont Clean Energy, 2015 Industry Report. Clean Energy Development Fund. 2015
publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/VCEIR%202015%20Final.pdf

³¹ The Economic Importance of Vermont’s Forest Based Economy 2013, North East State Foresters Association, 2015,
fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Vermont_Forests/Library/NEFA13_Econ_Importance_VT_final_web_Jan29.pdf

³² Department of Public Service, 2016 Plan, 2016, publicservice.vermont.gov/publications-resources/publications/energy_plan/2015_plan.

³³ Heat used in an industrial process rather than for space heating or other housekeeping purposes

primarily wood. The CEP establishes a goal of increasing that portion to 30% by 2025 through both efficiency and greater use of renewable fuels. A suggested pathway to this aim involves increasing the use of solid and liquid biofuels 20% by 2025, on the way to doubling wood's share of building heat by 2035.

While having robust markets for low-grade wood is critical to managing Vermont's forests, FPR also recognizes that the supply of wood fuel is finite. Several assessments of the amount of 'net available low-grade growth' in Vermont, appropriate for use as wood fuel, have been developed over the years, most recently by the Biomass Energy Resource Center at the Vermont Energy Investment Corporation in 2010. This study estimated that slightly less than 1 million green tons of wood (above current harvest levels) appropriate for use as wood fuel is theoretically available annually. It is important to note 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. Important factors that influence the capacity to sustain increased harvest rates include forest fragmentation and parcelization, landowner attitudes to harvesting forest products, the productive capability of the logging industry, and changing forest growth rates in light of climate change.

Several initiatives are currently in place, or planned, to advance these goals, including:

- **VERMONT STATEWIDE WOOD ENERGY TEAM:** A public, private, and non-profit partnership with the goal of increasing adoption of modern wood heating in schools and multi-family affordable housing by providing technical assistance and cost-sharing for installation. USDA Forest Service and the Clean Energy Development Fund provide funding for the project. The USDA Forest Service's Woody Biomass Technical Support Team also provides design review and engineering expertise to help ensure that state-of-the-art, high efficiency/clean burning technology is used in the installations.
- **CLEAN ENERGY DEVELOPMENT FUND (CEDF):** As part of its FY15 Plan, the CEDF selected advanced wood heating as its sector focus. The largest investment in this area was a \$1.6 million grant to a consortium working to promote advanced wood heating in Windham County. Also, CEDF has offered pellet-fired central heating incentives, advanced wood heating implementation grants in schools, and multi-family affordable housing and bulk pellet infrastructure grants.
- **WINDHAM COUNTY WOOD HEAT:** This initiative funded through the CEDF and staffed by the Northern Forest Center, assists municipalities and schools in Windham County to convert to heating with local, sustainable wood while addressing energy efficiency and durability needs. The program also includes public education, training for local building professionals, fuel supply procurement, and other elements needed to make Windham County a long-term hub of advanced wood heat technology and practice.
- **VT WORKING LANDS ENTERPRISE GRANTS:** The mission of the Vermont Working Lands Enterprise Initiative is to strengthen and grow the economies, cultures, and communities of Vermont's working

landscape. The Working Lands Enterprise Board achieves this by making necessary catalytic investments in critical leverage points of the Vermont farm and forest economy and facilitating policy development to optimize the agricultural and forest use of Vermont lands. To date, there has been \$811,510 invested in 29 forest businesses, and \$779,281 in forestry related service provider grants. Two of the projects focus on pellet production, totaling over \$88,000.

- **VT WOOD STOVE EXCHANGE PROGRAM:** This new initiative launched in 2016 provides a financial incentive toward the purchase of an EPA certified pellet and cordwood woodstove if an in-use uncertified woodstove is removed from service. The program is funded through the CEDF and will be administered by Vermont Energy Investment Corporation with assistance from ANR.

ASSESSMENT: TIMBER HARVESTING

In 2011, the Department of Forests, Parks and Recreation began an effort to collect data on the impacts (positive and negative) to several forest attributes and to compare the results with those of a similar assessment completed in 1990. The updated Assessment of Timber Harvesting and Forest Resource Management, completed in 2012, provides basic descriptive information about the number, sizes, and characteristics of timber harvesting operations around the state^[1]. It further provides a snapshot of harvesting practices related to specific forest attributes including aesthetic values; archeological and historic resources; rare, threatened, and endangered species; timber quality and regeneration, productivity, and health; water quality, and wildlife habitat.

Findings from the assessment include:

- The average size of timber harvests sampled was 62 acres, down from the average of 93 acres estimated during the 1990 assessment.
- 73% of sampled sites were enrolled in the Use Value Appraisal Program.
- Foresters were involved in 83% of operations.
- 49% of operations involved at least some mechanical harvesting.
- 41% of operations involved at least some whole-tree skidding, up from 10% in 1990.
- Regeneration harvests (overstory removal and clearcut) assessed in 2012 had a lower density of desirable seedling/sapling regeneration when compared with 1990 results.
- Soil disturbance on observed plots was minimal: no observed bare soil on 95% of points, no observed erosion on 96% of points, no observed compaction on 90% of points, and no observed rutting on 96% of points.
- Stream condition was not impacted by logging in 78% of observations.
- Stream buffer widths were considered adequate for 60% of observations.
- No evidence of sedimentation was observed at 78% of stream crossings.

- 42% of skid trails had drainage structures installed at the frequency recommended by the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont.

ASSESSMENT: CULTURAL AND NON-TIMBER FOREST PRODUCTS

Interest in non-timber forest products is increasing. These include medicinal and herbal products such as ginseng and goldenseal, decorative products including holiday greenery and vines, edible products such as shitake mushrooms and various nuts, and specialty products such as black ash for basketry. Forest landowners and collectors are encouraged to obtain landowner permission before collecting on Federal, state, or private property and to manage these resources sustainably. The USDA Forest Service report, Culturally and Economically Important Nontimber Forest Products of Northern Maine³⁴, provides information on many species of plants traditionally used for food, crafts, and medicinal purposes.

Vermont is the nation's leading maple syrup producer with operations across the state, primarily in small family businesses, though recently larger-scale producers have sprung up. Vermont maple syrup production in 2015 was 1.41 million gallons with an estimated value of production of \$46,530,000. Vermont produced 42% of the maple syrup produced nationwide that year. Modern sugarmakers rely upon vacuum and tubing sap distribution, reverse osmosis sugar concentration, and super-efficient evaporation systems. 'Sugaring Season' remains a quintessential Vermont tradition.

An estimated 232 tree farmers grow Christmas trees in the state. The Vermont Christmas tree industry has seen decreases in both numbers of farms and trees harvested annually. In 2015, Vermont harvested 134,500 trees, roughly a 20% decrease from 2007³⁵.

ASSESSMENT: WATER QUALITY

Forests are the best form of land use for sustaining water quality and quantity. Studies clearly show that the amount of forest land within a watershed is an indicator of water quality and healthy aquatic ecosystems. In urban areas, trees and forests are the community's "green infrastructure" and help reduce stormwater runoff. In rural areas, forests protect municipal water supplies, mitigate the impacts of flooding, replenish groundwater aquifers, and provide recreation and critical fish and wildlife habitat, as well as a variety of wood products.

³⁴ Culturally and Economically Important Nontimber Forest Products of Northern Maine. USDA Forest Service. 2010.

³⁵ US Department of Agriculture, National Agriculture Statistics Service, Nursery and Christmas Tree Production, 2015, www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Nursery_and_Christmas_Tree_Production/index.php.

ACCEPTABLE MANAGEMENT PRACTICES (AMPS)

Timber harvesting can directly influence water quality by affecting how water flows through a forest. Constructing roads, trails, and log landings can reduce soil permeability, increase soil erosion, and divert and concentrate water flow, leading to gullying. Concentrated water flow can also erode banks and put undue pressure on bridges and culverts. Best management practices (BMPs) are proactive and often voluntary practical methods or practices used during forest management to achieve a healthy sustainable ecosystem with a focus on water quality, forest soils, silviculture, wildlife, biodiversity, aesthetics, and recreation. In Vermont, the water quality practices are called “Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont” (AMPs). The purpose of the AMPs is to provide measures for loggers, licensed foresters, and landowners to utilize, before, during, and after logging operations to comply with the Vermont Water Quality Standards under the Federal Clean Water Act and to minimize the potential for a discharge from logging operations in Vermont.

The AMPs³⁶, which are legally enforceable rules required for Vermont land to comply with the Federal Clean Water Act, contain preventative measures to help control soil erosion and protect water quality. The AMPs are designed to minimize the effects of logging on the natural hydrologic functions of forests. The guidelines discuss how to absorb or disperse runoff, retain soil nutrients, filter sediment, prevent fluctuations in water temperature, and contribute organic material to surface waters. In place since 1987, the AMPs were revised in 2016 as a requirement of Act 64 with an improved set of practices to improve the water quality in Vermont.

FLOOD RESILIENCY AND STORMWATER MANAGEMENT

Forested areas provide multiple watershed benefits including their ability to help mitigate impacts from flooding. Forests intercept, evaporate, transpire, and infiltrate rainwater and snowmelt. They have the infiltrative capacity to absorb water, releasing it gradually, thus moderating streamflow. The forest floor is a critical watershed attribute of forested watersheds. The forest floor is composed of the litter layer, underlying organic layer, and fibrous roots. It controls storm runoff, stream sedimentation, and nutrient loading by encouraging surface water to infiltrate into the soil.

Maintaining or enhancing forest cover in a watershed should be a primary strategy in local planning efforts. Communities can also look at the amount of impervious surface in their watershed and explore strategies to encourage infiltration of surface runoff through Low Impact Development designs and green stormwater infrastructure practices. Vermont statute supports communities and state agencies to protect and restore upland

³⁶ Department of Forests, Parks and Recreation, Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont, 2016.

forested areas that attenuate and moderate flooding and fluvial erosion, and integrate green stormwater infrastructure to become flood resilient.

IMPAIRED WATERS FROM NONPOINT SOURCE POLLUTION

The Federal Clean Water Act requires states to establish water quality standards (WQS) in each waterbody that are sufficient to ensure, wherever attainable, a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water. It identifies impaired waters that don't meet these standards. Lake Champlain is one of these, but it is not the only impaired Vermont waterway. Seventeen of Vermont's waters are listed as "impaired," primarily due to urban stormwater runoff. These waters fail to meet the WQS based primarily on biological monitoring data. Once a waterway is listed as impaired, a Total Maximum Daily Load (TMDL) target is needed. A TMDL is an EPA approved target that attempts to limit and allocate discharge amounts among the various discharges to impaired waters to assure attainment with WQS. ANR recognizes the importance of managing the quantity and quality of stormwater runoff, especially within Vermont's stormwater impaired waters. The 2017 Plan focuses efforts on forestry related strategies to help remediate impaired waters, including implementing revised AMPs for Water Quality, providing technical assistance to loggers and landowners, and supporting green infrastructure.

PUBLIC DRINKING WATER SUPPLIES

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. Public water systems in Vermont are required to develop Source Protection Areas (SPAs) to protect public drinking water supplies, and subsequently, Source Protection Plans after the State Water Supply Division has approved the SPA. State rules regulate activities within SPAs. Forest management plans consider SPAs on both state and federal land in Vermont and with statewide emergency response plans.

PRIVATE FORESTS AND DRINKING WATER

The USDA Forest Service 'Forests to Faucets'³⁷ project uses geographic information science to model and map the continental US land areas most relevant to surface drinking water, the role forests play in protecting these areas, and the extent to which these forests are threatened by development, insects and disease, and wildland fire. This work can serve as an educational tool to illustrate the link between forests and the provision of surface drinking

³⁷ Forests to Faucets, USDA Forest Service, 2016, www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml

water—an essential watershed-based ecosystem service. This assessment provides information that can identify areas of interest for protecting surface drinking water quality.

Vermont ranks high in need to protect its surface drinking water. The primary area of concern is development pressure on forests in the Winooski and middle Connecticut watersheds, and the potential impact that it could have on water quality and water supply. These watersheds deserve the highest priority for protection and conservation to protect public drinking water supplies.

CLIMATE CHANGE AND VERMONT'S WATERS

Vermont and the region are expected to experience changes that could have critical consequences for hydrology, water quality, ecological integrity, and human infrastructure from more extreme and less predictable weather patterns. With more extreme precipitation events, flooding, and erosion concerns are likely to become more pressing. Vermont communities have already experienced an increase in the frequency of damaging floods in recent years, including the record-setting floods of 2011. Development in flood-prone areas is likely to significantly exacerbate this trend, as well as chronic instability from historic and current channelization of rivers and streams.

ASSESSMENT: AIR QUALITY

Trees and forest canopies cleanse the air by filtering airborne pollutants. Trees sequester many pollutants from the atmosphere, including nitrogen dioxide (NO₂), sulfur dioxide (SO₂), ozone (O₃), carbon monoxide (CO), and particulate matter of ten microns or less (PM₁₀). 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 SO₂ 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.

The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and indirectly by reducing energy consumption in buildings, which consequently reduces air pollutant emissions from power plants. In 2015, pollution removal by trees and shrubs in the City of Burlington was estimated using field data and recent available pollution and weather data. Burlington's urban forest is estimated to remove 77 metric tons of air pollution per year with an associated value of \$1.69 million³⁸. Currently, Vermont towns and cities are

³⁸ University of Vermont, Vermont Monitoring Cooperative, iTree Ecosystem Analysis – Burlington, 2015, www.uvm.edu/vmc/attachments/project/999/reports/2014_iTreeReport.pdf.

working to increase urban tree canopy cover to reduce stormwater flow, mediate air temperatures, mitigate carbon emissions, and filter air pollutants.

ASSESSMENT: FOREST-BASED RECREATION

Vermont has close to 926,000 acres of public lands open to recreation and thousands of miles of trails on public and private lands that serve hikers, mountain bikers, snowmobilers, all-terrain vehicle (ATV) riders, and other trail users. Federal, state, municipal, and non-governmental organization recreation providers manage parks, forests, wildlife areas, boat launches, and dozens of other types of outdoor recreation facilities and resources. Recreational trails are integral to public health, providing a wide variety of recreational opportunities for people to get outdoors and connect to Vermont's scenic and working landscapes.

Favorite winter outdoor sports include downhill and cross-country skiing, snowmobiling, dog sledding, ice climbing, and snowshoeing. Vermont had a record breaking 2014-15 ski season with 4,670,903 skier and rider visits, continuing an upward trend. Vermont has 24,000 registered snowmobilers in 120 clubs around the state, and the sport continues to be an important part of our winter economy³⁹. Summer and fall activities include hiking, camping, hunting and fishing, mountain biking, bird watching, and geocaching.

Outdoor recreation continues to grow in popularity and diversity in Vermont. Over the past 25 years, there has been a shift in the types of outdoor activities in which people are participating, away from pursuits such as hiking and towards more activities like mountain biking, trail running, backcountry skiing, and rock climbing. 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. Vermont has a tradition of working with non-profit partners and the volunteer clubs and chapters that they support to meet the challenge of providing outdoor recreation opportunities in a resource scare environment. 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 public recreational trails in Vermont total over 8,100 miles and are only made possible by the cooperation between federal, state, and private landowners.

³⁹Vermont Association of Snow Travelers, 2015. vtvast.org

Planning and investment are required to maintain current outdoor recreation facilities and resources and make new ones possible. Resources in Vermont for these projects include two grant programs administered by VTFRP: the Recreational Trails Program (RTP) and the Land and Water Conservation Fund (LWCF).

- **THE RTP PROGRAM:** RTP funds are used to maintain and develop trails for hiking, bicycling, mountain biking, running, walking, cross-country & back country skiing, snowmobiling, off-road all-terrain (ATV) & off-highway recreational vehicular (OHRV) riding, paddling, equestrian use, accessible trail-uses, interpretive use, in-line skating, & roller blading. FPR provides approximately \$1 million in funds each year to state and local projects.
- **THE LWCF PROGRAM:** This federal program provided through the National Park Service offers grants to assist states that can, in turn, pass grants through to municipalities. States must update their State Comprehensive Outdoor Recreation Plan (SCORP) every five years to qualify for LWCF funds. The purpose of the SCORP is to assess the supply, demand, quality, priorities, and issues surrounding outdoor recreation in the state, and set forth a plan of action for achieving the desired vision for outdoor recreation. Maintaining a current SCORP ensures Vermont's eligibility to receive funding for municipal and state recreation and conservation projects from the LWCF. Over 31 million of LWCF funding has been granted to Vermont between 1965 and 2015.

HIGHLIGHTS OF THE MOST RECENT (2014-2018) SCORP INCLUDE:

OUTDOOR RECREATION SUPPLY CHANGES

- Acquisition of 2,964 acres of land by the state in fee and 9,823 acres of land in easement, from January 1, 2010, through December 31, 2012; this land is now available for public recreation.
- An increase in mountain bike trails, mainly managed by the Vermont Mountain Bike Association and Green Mountain National Forest.
- Investment of over \$10 million for capital improvements in state parks to replace and update aging infrastructure and to add new facilities such as camping cabins, which have become very popular for state park visitors.
- Investment of millions of dollars by municipalities to expand and upgrade municipal recreation facilities including those significant areas affected by flooding in 2011.
- An increase in established ATV trails on private lands.
- New improvements to existing facilities to make them accessible to persons with disabilities.

OUTDOOR RECREATION DEMAND CHANGES

Vermonters participate in a wide range of outdoor recreation activities. In 2011, picnicking, swimming in lakes, and walking had the highest participation rates of all the activities included in the survey. The activities that were engaged in the most number of days of the year were walking, jogging/running, and riding ATVs. Some of the biggest changes in participation include:

- **TRAIL-BASED RECREATION:** Membership in almost all trail-based organizations listed in this plan has increased, and trail-based recreation activities were some of the most popular types of recreation in Vermont.
- **MOUNTAIN BIKING:** Kingdom Trails membership rose 140% since 2001, adding almost 2,000 people to its membership. Mountain bikers engaged in the sport an average of 16 days per year.
- **BACKCOUNTRY SKIING:** More and more Vermonters and visitors are choosing to ski off trail. The Vermont Backcountry Alliance is working with public agencies as well as resorts to promote and provide a safe backcountry experience.
- **ATVing:** The Vermont All-Terrain Vehicles Sportsman's Association's (VASA) membership has almost doubled since 2003, increasing to 2,564 members in 2010. ATV riding has the third highest average annual household participation days of any activity.
- **SNOWMOBILING:** Membership in the Vermont Association of Snow Travelers (VAST) has declined over the past ten years by over 10,000 members, dropping to 31,992 members in 2010. Even so, more than 10% of Vermonters snowmobile, for an average of almost 16 average annual household participation days.
- **HUNTING AND FISHING:** The sale of hunting licenses in Vermont has declined over the past ten years. The US Fish and Wildlife's National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR) survey found that the number of hunters in Vermont had declined by a third between 2001 and 2006.

VERMONT'S OUTDOOR RECREATION ECONOMY

Outdoor Recreation is not only a Vermont tradition, but an often-overlooked economic powerhouse. Healthy forests are the base of this industry. Recent studies have highlighted the economic importance of outdoor recreation:

- In 2016, four Vermont Trail System members (the Green Mountain Club, the Catamount Trail, the Vermont All-Terrain Sportsmen's Association, and Kingdom Trails Association) conducted an economic impact study on out-of-state visitation which found that just these four trail systems contribute \$30.8 million annually in economic activity through trail use. While an impressive number, this represents only a fraction of the economic impact outdoor recreation brings to the state annually.

- The Mad River Valley Active Transportation Plan found that three mountain bike/multi-use trail systems in the Valley account for over \$3.4 million in sales each year.
- The Outdoor Industry Association estimates that Outdoor Recreation generates \$2.5 billion in consumer spending each year.
- Vermont’s fall foliage season is world-renowned and is one of the most important times of the year for many tourism-based businesses. According to recent estimates by the Governor’s office, the fall season generates \$460 million in tourism spending from 3.57 million visitors, just over 25% of Vermont’s annual spending by visitors.

ASSESSMENT: FORESTS MITIGATION OF GREENHOUSE GASES

Trees of different species and ages can differ substantially in carbon uptake and storage amounts. Hardwoods with dense wood tend to store more carbon than softwoods with lighter wood. Young trees store only a fraction of the amount of carbon compared with older, large diameter trees. Annual uptake of carbon is related to tree vigor and growth rate, so healthy, fast growing trees can accumulate carbon faster. Factors influencing the amount of carbon in a forest include:

- Size of the forest area;
- Number, species, and age of trees;
- Soil type and depth;
- Amount of dead and down organic material; and
- Disturbances such as insect defoliations or ice storm damage, which can significantly reduce carbon storage in forests.

Land use change is a significant factor affecting Vermont’s forest carbon reserves. Emissions or sequestration of CO₂ can occur as land uses change. Vermont forests are considered a net sink, rather than a source, of CO₂, but where vast areas of forest land are cleared for agricultural or development purposes, this change in land use can be a net source of greenhouse gas emissions. Expanding areas of healthy forests will maximize carbon uptake and storage, more than any other land use. Where development does occur, planting trees will minimize carbon losses from soil, and accelerate vegetation growth to sequester additional carbon.



PRIORITY LANDSCAPES AND FOCUS AREAS

PRIORITY LANDSCAPE: LAKE CHAMPLAIN WATERSHED

Vermonters love Lake Champlain. Many refer to the lake as the region's crown jewel. We depend on the lake for fishing, swimming, boating, and other recreational pursuits. It provides drinking water to about 145,000 people or about 20% of the Basin's population⁴⁰. Summer tourism and property values are tied to its health and beauty. The lake attracts businesses with a workforce that appreciates its natural beauty and Vermont's working landscape.

The challenge is that too much pollution is reaching Lake Champlain from the streams and rivers draining into it. The primary concern is polluted runoff - rainwater or snowmelt that drains off parking lots, roads, and streets, farm fields and croplands, lawns, and logging roads. The water carries with it sediment, nutrients such as phosphorus that are naturally present in soils, pet and animal wastes, fertilizers, and other pollutants and then deposits these pollutants into streams and rivers or directly into Lake Champlain.

Too much phosphorus pollution stimulates excessive growth of algae. It can turn Lake Champlain water green, and even toxic to people and pets. To address phosphorous pollution in the lake, as prescribed in the Federal Clean Water Act, a TMDL is set that specifies the maximum amount of a pollutant that a waterbody can receive and still meet applicable water quality standards. The TMDL addresses all Vermont sources of phosphorus, including permitted point sources such as wastewater treatment facilities, municipal, and transportation stormwater sources, as well as nonpoint sources, such as runoff from agriculture and forests and stream bank erosion.

Sediment, which carries phosphorus, is the most common pollutant associated with timber harvesting. Soil is transported by rainwater after timber harvesting equipment and trees dragged or carried over the ground loosen and expose the soil. Bare ground exposed during harvesting operations can be eroded by rain and enter nearby streams. Stream crossings during harvesting have the potential for the biggest impact to water quality. In Vermont, the Environmental Protection Agency (EPA) estimates 14.5% of the total nonpoint phosphorus load delivered to the lake comes from forest land including natural background sources. The major form of phosphorus export to streams from forest land is sediment bound, usually associated with roads and stream crossings. With forests covering more than 1.9 million acres within the Vermont portion of the Lake Champlain Basin, forestry is an important area of focus for reducing phosphorus loading to state waters.

⁴⁰ Lake Champlain Basin Program, Drinking Water, 2016, lcbp.org/water-environment/human-health/drinking-water/.

The Vermont DEC, working with the United States EPA, began preparing the Lake Champlain phosphorus TMDL in the late 1990s. In 2011, the EPA revoked its approval of the Vermont portion of the Lake Champlain TMDL. After much analysis, planning, and public involvement, in June 2016, the EPA established new phosphorus TMDLs for the twelve Vermont segments of Lake Champlain. The updated TMDL includes several forestry strategies including revising the Forestry AMPs to enhance forest cover to improve watershed health.

In addition to the strategies listed above, additional pollution reduction strategies were identified for the Missisquoi and South Lake Sub-Watersheds due to their high phosphorus loads. The extra assurances provided for the forest sector for these areas include a focused outreach effort to target forest landowners to accelerate implementation of Natural Resource Conservation Service cost-share practices to improve water quality and reduce phosphorus and increasing access to portable skidder bridges.

PRIORITY LANDSCAPE: DEVELOPED LANDS-URBAN CANOPY ENHANCEMENTS

Urban land makes up just 1.6% of the land area of Vermont⁴¹. While a small percentage, 38.2% of Vermont's population lives in these urban areas and they rely on their urban and community forests to provide a multitude of benefits. The urban forest is the sum of street trees, residential trees, park trees and greenbelt vegetation; it includes trees on public and private land, in transportation and utility corridors, and forests on watershed lands. To assist in targeting resources to Vermont communities in greatest need of urban canopy enhancement, the Division conducted an assessment that identified communities that have less than average urban tree canopy (UTC) and higher than the average population, urbanized area, and impervious surface area. Enhancing the urban tree canopy in these regions will be a priority in this planning cycle to enable municipalities to reach their urban forests potential.

FOCUS AREA: WORKING LANDS ECONOMIC VITALITY

The backbone of Vermont's heritage and economic viability is its working landscape⁴² - comprised of agriculture, food systems, forestry, and forest product-based businesses. About 20% of Vermont's land is used for agriculture while another 74% is forested. Changing land use, development pressures, and macroeconomic trends are a direct threat to Vermont's working forestland base.

⁴¹ Urban and community forests of New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, U.S. Department of Agriculture, Forest Service, Northern Research Station. Gen. Tech. Rep. NRS-38. Newtown Square, PA. 2008

⁴² Imagining Vermont: Values and Visions for the Future; Report of the Council on the Future of Vermont. VT Council on Rural Development. 2009.

To address this issue, in 2012 the Vermont Legislature made a commitment to Vermonter's values by creating the Working Lands Enterprise Initiative to stimulate economic development in Vermont's agriculture and forest products sectors by making investments in entrepreneurship, business development, and job creation. The Initiative called for the creation of the Working Lands Enterprise Fund (WLEF) and the Working Lands Enterprise Board (WLEB). The WLEB is composed of public-sector members at all levels of the agriculture and forestry supply chains; and the Vermont Agency of Agriculture; Vermont Department of Forests, Parks, and Recreation; Vermont Agency of Commerce and Community Development; Vermont Housing Conservation Board; Vermont Economic Development Authority; and Vermont Sustainable Jobs Fund.

The WLEF has, over four years of granting, invested \$811,510 in 29 forest businesses, and \$779,281 in forestry related service provider grants.

The WLEB Forestry sub-committee is actively engaged in implementing recommendations from the recently completed Forest Sector Systems Analysis Project⁴³. These efforts seek to support forestry enterprises and value-chains through:

- **NETWORK DEVELOPMENT:** Develop a network of forest and wood products sector organizations to unite around a common purpose. The Vermont Sustainable Jobs Fund, the WLEB Forestry Sub-Committee, and the Northern Forest Center are collaborating and developing a plan to increase value chain coordination and to create a more formal network across the sector;
- **DEVELOPING VIABLE VALUE CHAIN OPPORTUNITIES:** Convene industry stakeholders interested in further exploring and then developing the value chain market opportunities identified through the systems analysis process;
- **IMPROVING PUBLIC AWARENESS:** Work with existing forest and wood products sector trade associations to improve public awareness and outreach to Vermonters, tourists, and the media; stress the importance of forestry to Vermont's economy and healthy forests; and increase demand for the wide range of forest and wood products;
- **ENGAGING WOODLAND OWNERS:** Support efforts to connect woodland owners to the working lands businesses that depend upon their forests;
- **STRATEGIC FUNDING:** Continue to invest in the forest and wood products sector through the Working Lands Enterprise grant program;

⁴³ Vermont Forest Sector Systems Analysis Final Report: VT Working Lands Enterprise Initiative. January 2016.

- **PROVIDING TECHNICAL ASSISTANCE:** Continue to support business planning and technical assistance efforts offered by Vermont service providers.

Maintaining focus and investment in Vermont's working lands and this important initiative will not only grow forest businesses but improve our economy overall and keep the landscape working.

FOCUS AREA: FOREST CARBON

Nationally, forests recover and store 15% of all CO₂ emissions from US sources⁴⁴, and the EPA estimates that improved forest carbon management could nearly double this to approximately 25% of US emissions. Maintaining Vermont's forests and managing them to maximize storage of carbon will be essential to combating the build-up of greenhouse gases in the atmosphere. Prompt emission reductions are needed to reduce the magnitude of climatic changes and predicted impacts. The pace of change and the rate of forest adaptation are much more feasible if we can reduce continued emissions and maximize opportunities for forest carbon sequestration. Forests sequester CO₂ better than any other land cover, and incentivizing this ecosystem service is in our best interest.

There is a need to develop public and private programs that provide payments to private forest landowners for management practices that increase carbon sequestration and provide other ecological services such as clean water and biodiversity. In regions where small parcels predominate, landowner cooperatives could facilitate participation in carbon markets. Practices that increase carbon sequestration may include: increasing above- and below-ground biomass retained on site for carbon storage, minimizing site disturbance where scarification is not an objective, and extending rotations and cutting cycles to develop late-successional stands comprised of a diversity of species.

FOCUS AREA: WATER QUALITY PROTECTION

As previously stated, forests are the best land use for sustaining water quality and quantity. The Division has a number of initiatives that promote the forests to faucet ideals.

PORTABLE SKIDDER BRIDGE INITIATIVE

The Division's Forest Watershed Program focuses on efforts to reduce nonpoint source pollution associated with forest management activities; accomplished through BMP monitoring, development and delivery of programs, and education and technical assistance to loggers, landowners, and natural resources professionals. BMP studies and audits conducted in Vermont have consistently shown that stream crossings are the principal source of sediment

⁴⁴ Environmental Protection Agency, 2014.

associated with logging operations. One way that Vermont is addressing this problem is through the Portable Skidder Bridge Initiative.

Portable skidder bridges are designed and intended for use as temporary structures for crossing streams during logging. Portable skidder bridges are a BMP for controlling nonpoint source pollution associated with timber harvesting operations. FPR, working with partners, is promoting and demonstrating the use of portable bridge designs on timber harvesting operations throughout Vermont. The use of portable skidder bridges as a method for crossing streams during logging operations is gaining popularity as loggers, landowners, and licensed foresters realize their environmental and economic advantages. Expanding the use and reach of this initiative will be an important strategy in our efforts to protect water quality.

GREEN STORMWATER INFRASTRUCTURE INITIATIVE

With the signing of Executive Order 06-12 in 2012, the State of Vermont recognized the important role that Green Stormwater Infrastructure (GSI) plays in enhancing and protecting water quality. Stormwater runoff from developed lands and lands undergoing development is a significant source of nonpoint pollution and GSI provides a mechanism through which that runoff volume and quality can be managed in a sustainable way using natural processes. GSI is a relatively new concept in Vermont and faces many barriers to statewide adoption and implementation, including a low level of awareness, a lack of technical details, limited incentives, and regulatory barriers at the local and state level. With the widespread recognition of the challenges posed by climate change and development, GSI can play a critical role in our approaches to stormwater management across Vermont's landscape.

To address this issue, we will work with our partners in our Urban and Community Forestry Program to strategically implement GSI practices on developed lands to augment treatment of stormwater and to reduce flows to existing traditional gray stormwater infrastructure. As FPR moves forward to mitigate the impacts of climate change, a focus on the goal of GSI must be a primary tool for stormwater management in Vermont.

FOCUS AREA: FOREST-BASED RECREATION

Forest-based outdoor recreation is a major component of Vermont's economy. Public lands, which make up 21% of the forest land in the state, provide a significant land base for all types of forest-based recreation in Vermont. These include state-owned lands and the Green Mountain National Forest, which have larger size parcels and provide opportunities and a continuity of management and a degree of management control that is not available on private lands. For these reasons, state lands are an obvious focus for our forest-based recreation strategies, and enhancing capacity on state lands is a priority in this plan update. Since private forest lands dominate across the state, they are vital to our forest-based recreation opportunities. To address this issue, we will employ strategies to support and facilitate forest-based recreation on private lands across the landscape.

In the 2017 Plan, we have reexamined and revised the goals and strategies from the 2010 Plan. They are intentionally broad and flexible and will be tied to specific projects and work plans during implementation. Although these focus on our DESIRED FUTURE CONDITION: MAINTAIN AND ENHANCE FOREST CONTRIBUTION TO ECOSYSTEM SERVICE they may apply to other Desired Future Conditions.

GOAL 6: MAINTAIN AND ENHANCE A SUSTAINABLE FOREST PRODUCTS INFRASTRUCTURE, WHICH ADDS VALUE TO THE VERMONT ECONOMY.

Strategy 23: Support research to improve our understanding of the value and sustainable use of all forest products and transfer this knowledge to landowners and land managers.

Strategy 24: Maintain a sustainable forest products economy and help diversify markets by assisting producers, providing workforce training, encouraging the use of local forest products, and supporting the Working Lands Enterprise Initiative.

Strategy 25: Encourage use of local wood in construction and furnishing, improving marketing opportunities for all wood products.

Strategy 26: Support the efficient and sustainable use of wood for fuel, following the recommendations of the 2015 Vermont Comprehensive Energy Plan, including maintaining forest health and forest carbon storage and uptake, using low-grade wood and clean wood energy technology, and promoting thermal energy use.

GOAL 7: MAINTAIN AND ENHANCE SOIL, AIR, AND WATER RESOURCES, AND INCREASE FLOOD RESILIENCE.

Strategy 27: Support research and monitoring that improves the understanding of trends in air quality, weather, and climate and their effect on forests.

Strategy 28: Support research and monitoring that improves the understanding of trends in soil conditions and relationships between forest management and soil health.

Strategy 29: Conserve, restore, and enhance soil health and hydrologic function on forest land.

Strategy 30: Identify, conserve, and enhance priority forests and forested riparian areas for water quality protection and flood resilience.

Strategy 31: Promote forest practices for water quality protection in new land development and retrofits including low impact development and green stormwater infrastructure.

Strategy 32: Address nonpoint source pollution associated with forest land and forestry operations to meet phosphorus reduction allocations across the landscape, including the EPA Lake Champlain TMDL.

Strategy 33: Encourage strategies that improve air quality and moderate air temperatures in urban and rural areas.

GOAL 8: MAINTAIN AND ENHANCE THE FULL SPECTRUM OF FOREST-BASED RECREATIONAL AND TOURISM OPPORTUNITIES.

Strategy 34: Build partnerships to support sustainable forest-based recreation and tourism, including new forms of recreation.

Strategy 35: Work with community groups and landowners to provide access to a well-maintained trail network for appropriate forest-based recreation.

Strategy 36: Increase engagement in forest-based recreation and tourism.

Strategy 37: Manage and maintain existing state-owned lands and recreation facilities for public use and support additional recreational opportunities where compatible with the resource and supportive of the Statewide Comprehensive Outdoor Recreation Plan (SCORP).

GOAL 9: MAINTAIN AND ENHANCE THE ROLE OF FORESTS IN CLIMATE CHANGE MITIGATION.

Strategy 38: Support research that improves the understanding, measuring, and monitoring of trends in forest carbon sequestration.

Strategy 39: Enhance forest carbon market opportunities.

Strategy 40: Manage for carbon sequestration and minimize emissions from forest-based activities and production.

Strategy 41: Strategically plant and conserve trees around buildings to mitigate energy demands.

Strategy 42: Support climate policy that reflects forest contributions to achieving substantial net reductions in greenhouse gas emissions.