The land, or more broadly, the natural earth, is the source of all that sustains human life. This fact is sometimes easy to forget in modern America. Water pours from our taps. Food is purchased, often already prepared, under the fluorescent lights of the supermarket. Clothing hangs from a rack at the corner boutique. Shelter is erected for us out of "construction materials" on "building lots."

Yet, we remain inextricably dependent upon natural systems. Traced to their origins, all of life's necessities are products of the earth and its processes. So are we. In addition to our productive resources in our farms, forests and mineral deposits, within our Region's boundaries are many ecologically sensitive areas and resources that serve as symbols of our natural heritage and barometers of the Region's environmental health.

OVERVIEW

Water Resources

The Region's ample water resources shape the landscape, support the larger ecosystem, and influence local land use decisions. Surface waters including rivers and lakes support recreational uses such as fishing, swimming, boating, wildlife observation and hunting. Surface waters and wetlands provide numerous habitats for a variety of aquatic and riparian plant and animal communities as well as recharge groundwater aquifers. Groundwater supports public and private water supply. Wetlands store floodwaters and filter natural and man-made contaminants. The quality of such water is essential to the health of the Region's population and economy.

- The Central Vermont Region comprises the following seven major watersheds: Winooski River, Connecticut-Johns River to Waits River, Connecticut-Waits River to White River, Lamoille River, Otter Creek, Passumpsic, and the White River.

- Well over half of Central Vermont's residents, and many of its businesses and industries receive their water from subterranean sources. In our rural areas, this figure rises to almost 100%.

- In general, groundwater sources in Central Vermont are plentiful and of good quality. Sources of groundwater contamination in Central Vermont, however, include domestic sewage, landfills, improperly disposed of hazardous wastes, leaky underground storage tanks, pesticides and fertilizers.

- In the Central Vermont Region, the land use and land cover of the Winooski watershed are very diverse from cities such as Barre and Montpelier to the farmland of Cabot and resort and ski areas of the Mad River Valley.

- Increases in developed land cover in watersheds result in significant changes in



watershed function and water quality. These changes occur as a result of increased impervious cover (pavement, rooftops, etc.). Urbanization increases storm water runoff and increases the flow of pollutants into waterways and wetlands.

- The Friends of the Winooski River, Winooski Conservation District and Vermont River Conservancy in partnership with agencies, willing landowners and volunteers have headed several successful efforts to improve long term conditions of the watershed in regard to water quality and flood reduction. For example, in Marshfield, native riparian trees and shrubs were planted along 5.6 acres of riparian land over the past two years.[1] Shrubs, trees and other vegetation can protect the stream from pollutants and runoff.

- Wetlands are areas of land that are "inundated or saturated with water for varying periods of time during the growing season."[2] Wetlands help make the environment more livable. They are among our most productive and diverse biological communities. They purify surface and underground water supplies. They are natural flood storage areas during wet periods and help maintain stream flow during dry spells.

- The Vermont Wetlands Program is responsible for identifying and protecting wetlands and the functions and values they provide. There are no Class 1 wetlands identified in the Region. There are just over 9,800 acres of Class 2 wetlands. Acreage is shown by town in Table 2. These wetlands account for 1.89% of land area in the Region. There are also likely many un-mapped wetlands within the Region, many of which may still be considered significant and protected under Vermont law.

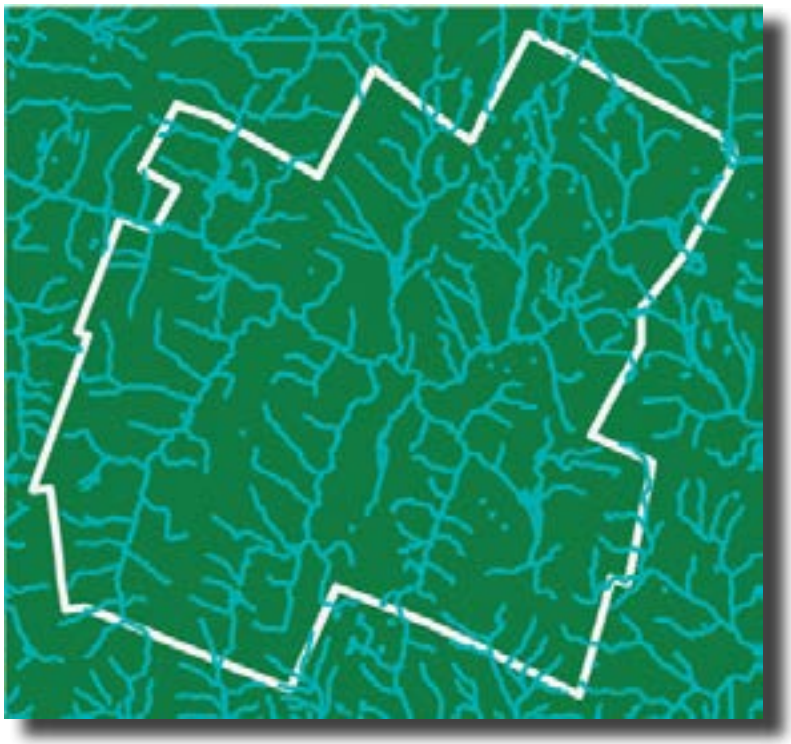
- The towns with the most significant percentage of Class 2 wetlands are Calais and Woodbury, with 4.8% and 4.5% respectively.

- Though region-specific information is not available at this time, according to Vermont Fish & Wildlife it is estimated that the current rate of regulated wetland loss in Vermont since 1995 is 20 acres per year. Common threats to wetlands include draining, dredging, filling and excavation activities associated with industrial, residential and agricultural activities.

Click here to view the **Water Resources Map**

1 Upper Winooski River Corridor Management Plan: Plainfield to Montpelier. Prepared by Round River Design. March 2010.
2 VT Agency of Natural Resources, Department of Environmental Conservation, Vermont Wetlands Conservation Strategy.

Surface waters cross political boundaries.



Types of Flooding

Floods cause damage in two distinct, but related, ways. *Inundation* flooding occurs where water rises into low lying land. Inundation can fill structures with water for an extended period of time and cause significant property damage. It is a great concern for those living in or near flood hazard zones.

Surprisingly, however, *fluvial erosion*, including bank failure and changes in river channel courses during floods, actually causes more damage. This more common mode of damage is associated with the dynamic, and oftentimes catastrophic, physical adjustment of stream channel dimensions and lateral movement during storm events. A flash flood is a sudden local flood, often due to heavy rain. Flash floods typically lead to erosive damage and can also mobilize large amounts of debris, plugging culverts, leading to even greater damage.


Inundation


Erosion

- The Winooski River Basin Water Quality Management Plan identifies impairments and threats to water quality (see **Appendix A**) and associated uses of our surface waters, including: sedimentation, siltation, turbidity, habitat alterations, nutrients, thermal modifications, flow alterations and metals as well as physical instability and river corridor encroachment.

- Water quality in Lake Champlain has been of particular concern as too much pollution is reaching Lake Champlain from the streams and rivers draining into it. The primary concern is polluted runoff carrying sediments and nutrients, such as phosphorus, discharging directly into streams and rivers of the Winooski Basin, other tributaries, and the Lake itself.

- As of November 2014, the State of Vermont and the U.S. Environmental Protection Agency are developing and implementing a new restoration plan for the Lake Champlain basin.

- This Plan, also known as the Lake Champlain Total Maximum Daily Load for Phosphorous, requires that Federal, State and local partners use a comprehensive approach to reducing pollution in the Lake. These efforts include increasing inspections and compliance efforts for farms and related stormwater control practices, increasing technical assistance in designing rural roads to reduce erosion and sedimentation, increasing the stability of our streambanks, and assisting municipalities in encouraging stormwater control practices in those projects that fall below the State permit threshold

Flood Resilience

Since the industrial revolution took hold, population, commerce, and infrastructure have historically been concentrated in the river valleys in Central Vermont. The Region's downtowns and village centers are largely located along the main stem of the Winooski River and its larger tributaries. These settlement patterns have left our

built environment particularly vulnerable to flooding. Strategies to floodproof and secure our existing settlements and infrastructure from future flood loss will be critical to public safety and economic vitality.

Flooding is Central Vermont's most common form of natural disaster (see **Appendix B: Past Flood Events**) and the most costly and dangerous to public health and safety. Floods can damage or destroy public and private property, disable utilities, make roads and bridges impassable, destroy crops and agricultural lands, cause disruption to emergency services, and result in fatalities.

- Most recently, in the worst flooding the State had seen since the Great Flood of 1927, the Winooski River and its smaller tributaries were cause of significant damage during May and August 2011 (Tropical Storm Irene) flood events as waterways over-topped their banks and suddenly turned violently destructive.

- Smaller scale flooding from more localized storms is more common. Impacts can be just as severe, but less widespread. Between 2011 and 2014, Central Vermont saw six Federally-declared disasters related to flooding.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is promoted by the Federal Emergency Management Agency (FEMA) to address inundation hazards in the Special Flood Hazard Area (SFHA). A municipality must adopt and enforce a floodplain management ordinance that must apply to at least the Special Flood Hazard Areas (SFHA) identified on the Flood Insurance Rate Map. The ordinance regulates new structures in the floodplain and places restrictions on other types of activities within the floodplain.

Areas prone to inundation by rising water during a flood with a 1% statistical probability of occurring in any given year (i.e., the "100-year Flood") are shown on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs).

- Since 1960, average annual precipitation in Vermont has increased 5.9 inches; almost half (48%) of this change in rainfall has occurred since 1990. According to the Vermont Climate Assessment Report (2014), precipitation has and will continue to increase, particularly in the winter months.

- The vulnerability of our Region's economic systems to increasing flood hazards became extremely evident during 2011 flood events, including Tropical Storm Irene, during which a great number of businesses and farms were directly impacted by flood damage and road closures.

- Considering all FEMA relief funding stemming from damages incurred in Tropical Storm Irene, the Region's Federal total came to a staggering $26,562,451 in damage and recovery costs.

River Corridor maps released by the VT Agency of Natural Resources outline areas prone to fluvial erosion hazards.

Above: River Corridors in areas surrounding Plainfield Village.

Table 1: Land Use in the Special Flood Hazard Area

Developed	13.6%
Undeveloped	84.4%
Surface Water	2.1%

Source: CVRPC

- Region-wide, 3.13% of the land area (16,313 acres) is located within a mapped Special Flood Hazard Area (See **Appendix C: Flood Hazard Areas**).

- The Vermont Agency of Natural Resources has produced River Corridor maps that define boundaries to the area the river needs to maintain a stable stream channel. The River Corridor area boundaries also attempt to capture the lands most vulnerable to erosion hazards.

Click here to view the Flood Resilience Map

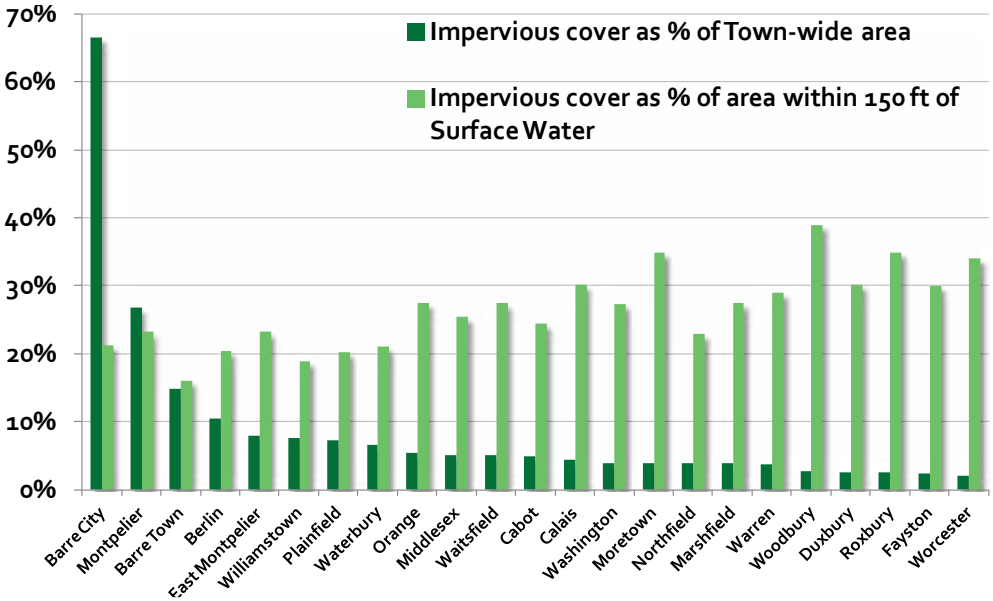
- All of Central Vermont's 23 municipalities participate in the National Flood Insurance Program and enforce flood hazard regulations, though some communities have chosen to adopt higher regulatory standards than the minimum required by FEMA in order to reduce flood risk and ensure safer development.

- A number of communities are also adopting regulations that limit development in the River Corridors, as mapped by the VT Agency of Natural Resources, in order to reduce vulnerabilities to erosion hazards and associated flash flooding.

- Preservation of open space is another important strategy for keeping the floodplain free of development and serving primary natural functions. As shown in Table 7, an analysis of existing land cover indicates that roughly 84.4% of the Special Flood Hazard Area region-wide remains undeveloped.

- Communities that wish to become more resilient to future floods can also implement policies to more effectively manage stormwater throughout the entire watershed. Adopting these policies can help slow stormwater, spread it out over a larger area, and allow it to sink into the ground rather than immediately flowing into nearby streams and rivers causing them to rise more rapidly. In this vein, many municipalities in Central Vermont have adopted riparian setback and buffer ordinances that require structures to be placed a certain distance from a stream or other surface water and the protection or maintenance of vegetation.

Figure 2: Percent of Impervious Cover by Town



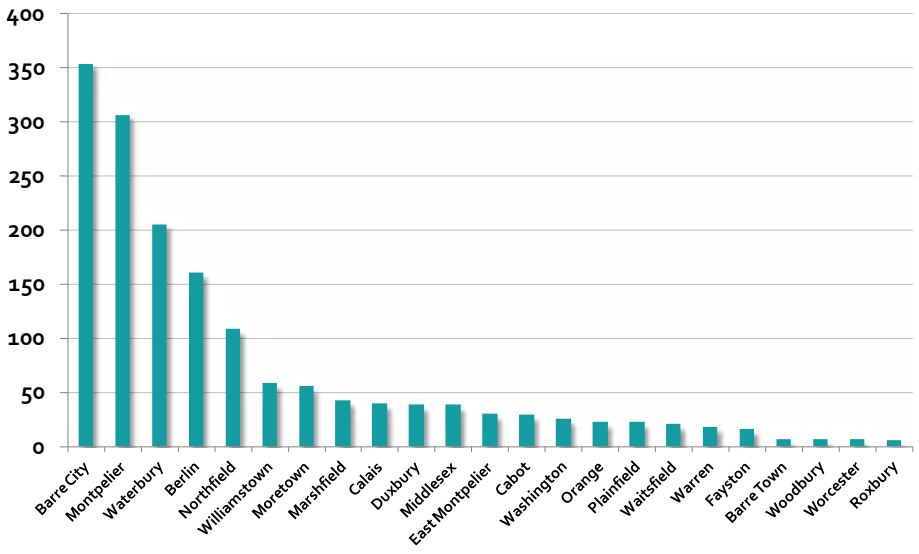
Source: Results based on a statewide analysis completed by Chittenden County Regional Planning Commission, July 2013.

- Figure 2 portrays impervious cover as a percentage of town-wide land area for each municipality in conjunction with impervious cover as a percentage of land area within a 150 foot buffer from surface waters. The urban core of Barre

City, Montpelier, and Barre Town represent the highest percentages of impervious cover town-wide, with the remainder of communities less than 10% impervious.

- Figure 2 also shows a trend of less-developed communities tending to have higher amounts of impervious cover as a percentage of land area within 150 feet of surface waters. This percentage is likely impacted by roads and driveways built near waterways, which can have implications for water quality, stormwater management and flooding as it relates to infrastructure vulnerability and erosion.

Figure 3: Structures in the Special Flood Hazard Area by Town



Source: e911 points and FEMA Flood Insurance Rate Maps (FIRMs)

- Transportation infrastructure is a major source of stormwater runoff in Vermont that can alter hydrology and contribute significant quantities of pollution to surface waters.

- The Vermont Agency of Transportation encourages and incentivizes the municipal adoption of standards that meet or exceed the 2013 state-approved Town Road and Bridge Standards. These standards increase the likelihood that town roads and bridges will hold up during flooding or heavy rain events and also address water quality issues associated with roadway run-off.

- Based on the results of overlaying the FIRM flood maps with the location of e911 points, over 1,600 of the Region's structures (5.5%) are vulnerable to potential flooding as of 2014. Over 70% of those vulnerable structures are in regional population centers Barre City (353), Montpelier (306), Waterbury (205), Berlin (160) and Northfield (108).

- Of the over 1,600 structures located in the regulatory floodplain, only 48 % (774 structures) carry flood insurance. Issues preventing residents of Central Vermont at flood risk from obtaining insurance range from a lack of awareness regarding flood risk, rising premium costs due to recent legislative changes and the costs to obtain a surveyor-certified Elevation Certificate in order for the NFIP to rate the property.

- Many towns are still struggling with the costs of permanent repairs to infrastructure from the widespread damage. While the State of Vermont reported that between 1989 and 2003, Central Vermont received $5,119,738 in total Public Assistance allocations during Presidentially Declared Disasters, Tropical

Table 2: Land Cover by Type

Land Cover Type	% of Total
Deciduous Forest	38%
Mixed Forest	29%
Evergreen Forest	13%
Pasture Hay	5%
Developed, Open Space	4%
Cultivated Crops	3%
Shrub/Scrub	2%
Woody Wetlands	2%
Developed, Low Intensity	2%
Open Water	1%
Developed, Medium Intensity	1%
Grassland/Herbaceous	0.5%
Developed, High Intensity	0.2%
Barren Land	0.2%
Emergent Herbaceous Wetland	0.1%

Source: NLCD 2006

Storm Irene (2011) alone brought an allocation of $7,953,704 in Public Assistance funds to repair the publicly-owned infrastructure due to damage.

- The damages from Irene adversely affected the sensitive populations of Central Vermont. Though mobile homes comprise 6% of total housing units region-wide, that number jumps to 23% when considering all residential structures located in the special flood hazard area.

- Effective public information and outreach is an important component of mitigating future flood losses as a diverse collection of community interests are involved in or affected by flood hazards within the Region. A number of communities maintain flood-related information on their municipal web sites, conduct outreach to floodplain residents and business owners, and make FEMA and State flood hazard publications available at municipal offices, libraries other public buildings.

Forest Land

Forestlands provide many benefits to Central Vermont residents. Forests contain habitat essential to a variety of wildlife species and help protect and replenish surface and groundwater supplies. They also perform an important atmospheric cleansing function protecting the quality of the air we breathe. Many recreational pursuits are dependent on, or enhanced by, forestland, as is the aesthetic quality of the Region.

- As shown in Table 8, the vast majority (approx. 80%) of the Region is forested. These forests are characterized by diverse landscapes and elevations and such diversity contributes to varied vegetative types and natural communities, including: early succession forests, northern hardwood and spruce-fir forests, sub-alpine forests, cliffs, rock outcrops and wetlands.

- There are nearly 357,000 acres of privately owned forestland in Central Vermont (86% of forested acreage) and 59,549 acres of National and State Forests, State Parks, Wildlife Management Areas and Town Forests.

- Since private landowners own a majority of the Region's productive forestland, it is important to encourage sound, long-term forest management and compatible patterns of growth and development, while respecting the rights of private property owners. Productive forestlands are defined as all large tracts which in themselves, or when combined, form a major economic unit for long-term timber production. Benefits of forest management include providing a sustainable source of forest products, increasing the diversity of habitats for wildlife, and offering scenic beauty and places for recreation.

Click here to view the HABITAT BLOCKS Map

- Non-native, invasive plants present a variety of threats to forest health in Vermont and the northeast. Invasive plants such as bush honeysuckles, buckthorn, autumn olive, and Japanese barberry crowd out native plants in upland forests, reduce habitat quality and biodiversity in forest ecosystems, are expensive and difficult to control, and can have other negative economic impacts.

- In riparian areas and along rural roads, Japanese knotweed

has become a widespread invasive nuisance; typically sprouting in disturbed areas or spread via moving ice jammed up along a stream bank. In order to mitigate the impacts, eradication efforts would have to begin at the top of the watershed and work downstream.

- The Vermont Department of Forests, Park and Recreation conducts aerial and ground surveys to detect forest damage. Counts were made of known occurrences by town and categorized into 4 classes (0, 1-2, 3-7, 8-13). Much of the Central Vermont communities had some observances, with East Montpelier and Orange in the 3-7 range and Calais, Marshfield, Plainfield, Middlesex, Waterbury, Berlin, Northfield, Barre Town and Williamstown in the 1-2 range.

Wildlife Habitats

All species of wildlife are integral to the functioning of the ecosystems upon which we all depend and two-thirds of Vermonters take part in wildlife-associated recreation. We know that viable habitat is the single most important survival need for these species; yet for many, habitat loss and fragmentation is a real and present threat. Wildlife habitat at the regional level is best supported by maintaining large contiguous blocks of forest land.

- Contiguous habitat supports native plants and animals, including species like bobcats and black bears that require large areas to survive, as well as animals with relatively small ranges such as salamanders that utilize these corridors in order to find seasonal sources of food, to breed, or to hibernate. Additionally, contiguous forest can buffer species against the negative consequences of fragmentation.

- The Central Vermont region has a significantly fragmented habitat, with some large blocks of contiguous habitat remaining in the foothills and spine of the Green Mountains, the Worcester Range, Groton State Forest and the Northfield Range.

- The National Audubon Society (Audubon Vermont) has identified three priority forest bird blocks within the county, denoting its significance to bird conservation within the State. These include the Northern Green Mountains Important Bird Area (IBA), an IBA encompassing the spine of the Green Mountains north of the Winooski River and the Worcester Range within the Region. This forest block supports breeding populations of Bicknell's Thrush, a species of global conservation concern.

- Riparian areas serve important habitat functions and provide connecting corridors for wildlife movement. Riparian areas are ecosystems comprised of streams,

Critical Resource Areas

For the purposes of this Plan such critical resource areas include:

- National Natural Landmarks: a designation that encourages and supports the voluntary conservation of sites that illustrate the nation's geological and biological history, and strengthens the public's appreciation of America's natural heritage;

- State-designated Natural Areas (more info >>): limited areas of land which have retained their wilderness character, although not necessarily completely natural and undisturbed, or have rare or vanishing species of plant or animal life or similar features of interest which are worthy of preservation for the use of present and future residents of the state and may include unique ecological, geological, scenic and contemplative recreational areas on state lands;

- Sites listed on the Vermont Rare, Threatened and Endangered Species, and Significant Natural Communities as designated by the Vermont Natural Heritage Inventory; and

- Elevations over 2,500 feet as shown on USGS topographic maps.

Vermont's Biofinder Tool

The BioFinder component map (see link below), included here for educational purposes, represents a compilation of available terrestrial and aquatic biological, ecological, and natural heritage data in the Region. BioFinder's Tiered Contribution to Biodiversity layer shows the relative concentrations of natural resources. For example, an area could be a Tier 1, which means that it has the highest concentration of biodiversity components, or Tier 4, which means it has a moderate concentration of biodiversity components. While not used for regulatory functions, this map can be used as a reference to give a broad, biologically inclusive, overview of an area and aid in conservation planning.

To view the map at different scales, an interactive mapping tool developed by VT Dept. of Fish & Wildlife is available at: http://biofinder.vermont.gov/.

Click here to view the BIO FINDER Map

rivers, lakes, wetlands, and floodplains that form a complex and interrelated hydrological system. These ecosystems extend up and down streams and along lakeshores, and include all land that is directly affected by surface water.

- The more developed areas of the region, which tend to be located in river valleys, exhibit increasing amounts of habitat fragmentation.

- According to a recent state-wide study, the number of parcels containing more than fifty acres of woodland (undeveloped land with relatively intact forest) has decreased in Vermont by four percent (4%) betweem 2003 and 2009. This is in step with the character of incremental growth and development in Central Vermont.

- Within our Region's boundaries are many ecologically sensitive areas and resources that serve as symbols of our natural heritage and barometers of the Region's environmental health. These environmentally sensitive lands have great value for education and research and for the understanding and appreciation of natural systems and processes. They perform critical ecological functions, enhancing the stability and diversity of ecosystems. For the purposes of this Plan, special considerations are made for *Critical Resource Areas*.

- Camel's Hump Natural Area was designated a National Natural Landmark in 1968 and is also a State-designated Natural Area.

- In addition to Camel's Hump, other State-designated Natural Areas include the portions of Mount Mansfield Natural Area in the Town of Waterbury, which encompasses an extensive and unbroken subalpine heath krummolz community and a subalpine spruce-fir forest, and Worcester Range Natural Area spanning the Towns of Middlesex, Waterbury and Worcester.

Agricultural Lands and Soil

Farming helps to define the Region's cultural identity and provides Central Vermont residents with open space, recreational opportunities, aesthetic pleasure, and a sense of place. More importantly, farms and farm soils, if protected now, can assure us of some degree of Regional self-sufficiency in the event that outside food supplies dwindle, are cut off, or become prohibitively expensive. While such scenarios may seem farfetched for the short term, a number of circumstances already in motion could make them a reality within our lifetime. Among such circumstances are: global climate change, dwindling and expensive energy reserves, disease susceptible mono-culture farming in major production areas, soil salinization and water shortages in these same locations, trade fluctuations, and worldwide population increases.

The limited supply of primary agricultural soils, their general suitability for septic

systems, combined with agriculture's increasing dependence on higher quality land make it crucial that land use decisions display foresight and recognize the importance of these soils to future generations.

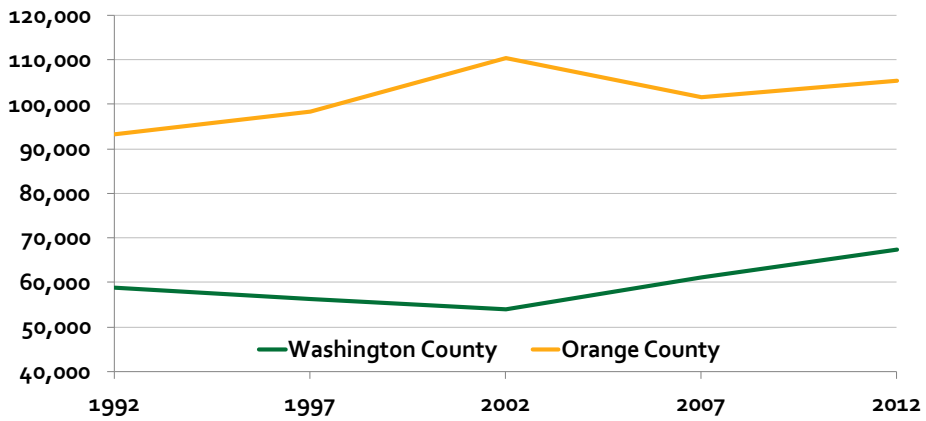
- As of 2012, over 67,000 acres in Washington County and over 105,000 acres in Orange County were open and agriculturally managed lands. This accounts for just over 15% of all land within Washington County and nearly 24% in Orange County.

- Total acreage of farms in both counties increased between 2007 and 2012, with an overall slight increase over the past two decades (Figure 4).

- Primary agricultural lands are a finite resource, and preventing conversion of these critical soils to other uses should be a priority in our efforts to maintain a viable agricultural base.

- A number of Central Vermont communities have put protection for prime agricultural soils into their zoning and subdivision regulations requiring or encouraging the siting or clustering of development at the edges of open spaces and agricultural lands in a way that leaves land open for farming or recreational use.

Figure 4: Agricultural Acreage, 1992-2012



Source: US Agricultural Census

View of a dairy farm in the Town of Washington.

- Accommodating diversified agricultural enterprises and reducing barriers or added permitting to these types of uses can also serve as a barrier to the viability of prime agricultural land. Conditional uses listed in zoning districts targeted for agricultural such as "small-scale processing of farm and forest products" or "special events" are a few examples employed by the Town of Waitsfield.

Click here to view the AGRICULTURAL LANDS AND MINERAL RESOURCES Map

Mineral Resources/Earth Extraction

The mineral deposits of Central Vermont are recognized as an important, yet finite, resource. The presently known mineral resources of the Region include granite, talc, asbestos, chromite, verde antique, sand, and gravel. The granite quarries of Barre Town and granite industries of Barre City,

Berlin, Calais and Montpelier are contributors to our economy and living monuments to a colorful part of our Regional heritage. While sand and gravel deposits are less renowned, they play an important part in local and personal economies and are relied upon by municipalities for road building and maintenance materials. The products of earth resource operations are important and we must accommodate them even as we guard against their more harmful aspects.

- According to the U.S. Geological Survey's Mineral Resources Data System, there are at least 17 actively producing mines in the Region and over 50 formerly operating sites. Open pit mining is the most common method employed.

- Towns that wish to encourage sand and gravel operations in specific locations should make sure that their conditional use standards are clearly written, administered fairly, and that they balance the interests of the town, the facility owner/operator and the neighboring landowners.

Renewable Energy Resources

The Region's natural resources are also potential sources for renewable energy generation as we strive to reduce fossil fuel consumption and dependence. Opportunities for hydro-power, biomass, biofuels, methane, wind and solar energy generation should all be considered in resource conservation policies and strategies. There can be significant natural resource impacts associated with energy development and resource extraction. Proposed energy developments should consider the costs related to impacts on the resource in tandem with the value of the energy produced. For additional information and analysis, see the Energy element of this Plan.

Air Quality

Overall within the Region, given the lack of industrial development, local air quality concerns are limited mainly to emissions from traffic, heating systems and some agricultural practices.

View from the Scenic Mad River Byway, Rte 100B in Moretown.

•Neighboring Chittenden County is currently at risk for non-attainment status due to the amount of particulate matter and ground level ozone. There are no available data that identify how much ozone and particulate pollution is generated locally, compared to the amount that blows into our area from areas upwind of Vermont. The only pollution sources that we can directly affect are local sources. The cumulative effect of these sources may increase with additional growth and may have greater impact on local air quality.

• On a local level, most Central Vermont communities have chosen to include some type of performance standards in their zoning regulations

that address objectionable elements that may degrade air quality in the surrounding areas.

Natural Scenic Areas

Central Vermont is a place of celebrated natural beauty. Its scenic landscapes not only enrich lives and spirits and attract new businesses and residents, they also provide the basic ingredient for one of the Region's most important industries – tourism. Each year thousands of visitors travel here to see the mountain vistas, pastoral scenes, fertile valleys, historic villages, Interstate 89 corridor (which has received awards for its scenery), remote back roads, and woodlands ablaze with autumn color. Thus, it is in our best interest, both psychologically and economically, to preserve the best of Central Vermont's visual splendor.

- Landscape diversity is also an important consideration in addition to individual scenic elements. Areas immediately adjacent to scenic corridors, such as open agricultural lands or a wetland, can be equally important to the scenic qualities as the prominent ridgelines or large body of water that frame the vista.

- There are two Federally- and State-designated Scenic Byways in the Region. Scenic byways are designated for their intrinsic archaeological, cultural, historic, scenic, natural and recreational values and the Green Mountain Byway and Mad River Byway both boast unique landscape elements and viewscapes that are highly valued for scenic qualities and for contributing to quality of place and tourism.

- Broader development patterns and types occurring in the Region and other factors that impact scenic resources include scattered residential development and forest fragmentation, climate change and impacts on forests (including foliage impacts), proliferation of telecommunication towers on hilltops and ridgelines, utility line corridors, and development of commercial-scale solar arrays or wind farms.

Outdoor Recreation

One of Central Vermont's greatest recreational "facilities" is its landscape. Besides being the home to one of Vermont's last undeveloped mountain ranges (the Worcester Range), only undeveloped alpine area (Camel's Hump), a bounty of mountains, rivers, lakes, forest and fields, it provides a virtual playground for residents, neighboring

Statewide Outdoor Recreation Trends

The 2014-2018 Vermont State Comprehensive Outdoor Recreation Plan (SCORP) highlighted a number of statewide trends that may have implications for recreation within the Region. These include:

- An increase in membership in all trail-based organizations.
- An increase in mountain bike trails, particularly trails managed by the Vermont Mountain Bike Association and Green Mountain National Forest,
- An increase in established ATV trails on private lands, and VASA's membership has almost doubled since 2003.
- A decrease in VAST membership over the past 10 years, though more than 10% of Vermonters participate in snowmobiling.

regions, and out-of-state visitors alike. The Region boasts some 59,549 acres of public outdoor recreational lands. These include a National Forest, seven State forests, four State parks, five wildlife management areas, and municipal forests in almost all of the towns in Central Vermont. In addition, there are public parks and playgrounds, as well as State surface water access points.

While these publicly-protected lands contain some of Central Vermont's finest scenery, natural resources, and recreational opportunities, such values are abundantly represented in many of the Region's private holdings, as well. Accordingly, un-posted private lands are an important piece of Central Vermont's recreational tapestry.

- Forested lands support a variety of outdoor recreational activities as well as the tourism industry. The Green Mountain National Forest (GMNF) encompasses more than 400,000 acres in southeastern Addison County and Central Vermont in the Green Mountain Biophysical Region, forming the largest contiguous public land area in the State.
- An impressive network of trails traverses the Region including approx. 23 miles of the Long Trail, the oldest long distance hiking trail in America. Multiple opportunities for loop-hikes or end-to-end hikes create attractive options for day-hikers and backpackers.

Table 3: Select Trail Resources by County

County	Municipal Hiking Trails (miles)	Municipal Bike/ Pedestrian Trails (miles)	*VAST Trails (miles groomed)*
Chittenden	83	99	*146*
Washington	58	13	*476*
Orange	36	22	*505*
Windsor	36	19	*463*
Rutland	28	16	*471*
Bennington	24	5	*198*
Addison	22	14	*234*
Windham	19	8	*283*
Orleans	15	1	*405*
Franklin	11	3	*276*
Lamoille	10	10	*244*
Caledonia	8	9	*504*
Grand Isle	3	5	*33*
Essex	0	1	*487*

Source: State Comprehensive Outdoor Rec. Plan 2014-2018, VAST

- Other popular hiking trails include those of the Worcester Range that traverse the exposed summits of Mount Hunger and Mount Worcester. Various trails exist in the vicinity of Groton State Forest, including the popular Spruce Mountain hike, and in the vicinity of Paine Mountain in Northfield.
- Multi-use trails under continued development and expansion within the Region include the Cross Vermont Trail and the Mad River Path. The Cross Vermont Trail, a designated National Recreation Trail since 2003, will eventually bisect Vermont through the Wells River and Winooski River Valleys, connecting Newbury on the Connecticut River with Burlington

on Lake Champlain. Currently 30 of the 90 miles of Cross Vermont Trail have been completed and are open for use.

- Mountain biking has seen increased participation over the past decade according to the 2014-2018 State Comprehensive Outdoor Recreation Plan (SCORP). New and expanded trail systems at Shaw Outdoor Center (Norwich University), in the Mad River Valley and at Millstone Trails in Barre Town have fueled the sport's popularity and tourism potential within the Region

- Orange County has the most miles of groomed snowmobile trails of all the counties in Vermont at 505 miles. Washington County towns in the Upper Winooski River corridor have a large concentration of groomed snowmobile trails, with fewer trails in the more mountainous, ecologically sensitive areas. There are also a variety of trails for all-terrain vehicles (ATVs) in the Region, many of which are on private lands.

Barre Town Forest

The most recent addition occurred in April of 2013 with the creation of the Barre Town Forest. Protection of this 355-acre forest near the villages of Graniteville and Websterville was an effort involving local officials and non-profits, the Trust for Public Land and the USDA Forest Service. Barre Town Forest is actively managed for timber, has a disc golf course, and provides a variety of popular trails used for hiking, mountain biking, snowmobiling and cross-country skiing.

- The Central Vermont Region is home to one of Vermont's largest alpine ski resorts, Sugarbush Resort, one of its most iconic, Mad River Glen, and is within a half hour drive of several others. Sugarbush and Mad River Glen generate approximately 385,000 skier-visits on an annual basis and during the 2012-2013 season at Sugarbush, skier visits were up 44% over the previous season.

- The ski industry continues to be a major draw for the Region's tourism economy; however, as economic pressures and warming winters have impacted the industry, the ski resorts have begun to shift toward more four season activities.

- The popularity of back-country skiing in Vermont has continued to increase and the opportunities and issues this activity poses are also on the rise. This use is increasing rapidly at developed ski areas.

- Nordic skiing is also a popular pursuit in Central Vermont, and Orange and Washington Counties together boast 89 miles of nordic skiing/snowshoe trails (ranking second and third statewide to Chittenden County's first, respectively). A section of the Catamount Trail, a 300 mile Nordic ski trail that spans the State north to south, traverses the Towns of Warren and Fayston. Various commercial nordic ski areas also serve the Region.

- Central Vermont offers a variety of warm-water and cold-water fishing opportunities. Sections of two of Vermont's largest and most productive trout streams, the Lamoille and Winooski rivers, as well as the Waterbury Reservoir, are accessible to the Region's residents. It is also home to the Dog River, one of Vermont's top wild trout streams, and the

Click here to view the RECREATIONAL RESOURCES Map

Woodbury-Calais Lakes region which offers good to excellent fishing for trout, bass, and panfish.

- Over a quarter of Vermonters participated in hunting-related activities in the past year. Big game hunting, which for most Vermonters means deer hunting, was the most popular form of hunting in the State. Other popular game include black bears, wild turkey, moose, duck, goose, rabbit, partridge and coyote. Central Vermont is home to numerous Wildlife Management Areas and allows hunting in designated areas of State Forests and State Parks within the Region.

- The sale of hunting licenses in Vermont has declined over the past 10 years, but fishing license sales and participation are holding steady.

- Water-based recreational opportunities are also abundant in the Region in the warmer months. The Winooski River Paddlers' Trail is an 80-mile trail from Cabot to Lake Champlain on the Colchester/ Burlington border.

- The Mad River, Dog River, Wrightsville Beach Recreation Area and various ponds throughout the Region are also popular paddling spots. There are numerous public access points for motorized boating and fishing in the Region's ponds, as well.

- Disc golf, also known as Frisbee golf, is a relatively new sport that is gaining popularity in the Region with residents and visitors. There are at least 5 public courses, including Wrightsville Beach, Millstone Trails, Sugarbush Resort (2 courses), and Waterbury Center, as well as a few private courses.

- With increased demand for more diversified facilities like multi-use trails that support a variety of activities, public land managers are faced with the challenge of maintaining recreational trails and structures in light of the increased and diversified use.

- Recreational access to private land remains an ongoing discussion and point of debate among certain recreational user groups and property rights advocates. Though statewide data on acres of posted land shows that the amount of land posted remained relatively constant from 2000 through 2010, not all posted land is registered with town clerks.

- With the vast amount of developed and yet un-tapped recreational resources, much of which are tucked away in the Region's more rural communities, there is opportunity for both a more coordinated approach to recreation planning that could increase connections between the various trails, recreation areas and communities and for more coordinated marketing of these assets to support awareness among both visitors and residents.

Conserved Lands

Vermont residents and visitors benefit from the natural assets supplied by permanently protected parcels, whether the land is conserved and maintained by private landowners, held as a preserve by a nonprofit land trust, or managed as a park, refuge or multiuse area by a government entity. The majority of the larger blocks of conserved lands in the Central Vermont Region can be found along the spine of both the Green and the Worcester Mountains as well as adjacent to Groton State Forest.

Many smaller private properties have been conserved with the assistance of land trusts such as the Duxbury Land Trust and the Vermont Land Trust (See **Appendix D: Conservation Organizations**). In addition, properties that are 25 acres or more are eligible for enrollment in the State of Vermont's Current Use program.

- Almost half of all Vermont towns own a community forest. In the Central Vermont Region, there are town and/or school forests in Barre Town, Berlin, Cabot, Calais, Duxbury, East Montpelier, Fayston, Marshfield, Middlesex, Moretown, Northfield, Orange, Plainfield, Roxbury, Waitsfield, Warren, Washington, Waterbury, Williamstown, Woodbury and Worcester.

- Forty-two percent (42%) of the land in the Region is enrolled in the Current Use program. Towns with the largest percentages of their land in Current Use include Moretown (60.5%), Washington (55.6%), Northfield (55.2%), Cabot (55.1%) and Woodbury (53.8%).

- Over a ten year period, the number of acres in the Region enrolled in the Current Use program grew from 187,835 in 2003 to 222,640 acres in 2013. Towns enrolling the largest number of acres over the ten year period included Northfield (4,890), Fayston (3,560), Orange (3,523) and Warren (2,069), together accounting for over 40% of the Region's new enrolled acres since 2003.

Click here to view the CONSERVED LANDS Map

- Municipal conservation commissions play an important role in maintaining and enhancing natural resources in the Central Vermont Region. Towns with established commissions include: Berlin, Cabot, Calais, Fayston, Marshfield, Middlesex, Montpelier, Northfield, Plainfield, Waitsfield, Warren, Waterbury and Worcester.

- Some conservation commissions are also involved in local planning efforts, particularly in the review of the 'Natural Resources' section of a town plan and comment on local permit applications that might have an adverse environmental impact if approved.

Climate Change

From the Lake Champlain shore to the Connecticut River Valley, the climate of Vermont is changing. Records show that spring is arriving earlier, summers are growing hotter, and winters are becoming warmer and less snowy. These changes are consistent with climate change, an increasingly urgent phenomenon driven by heat-trapping emissions from human activities.

Research shows that if greenhouse gas emissions continue to grow unabated, Vermont can expect dramatic changes in climate over the course of this century with substantial impacts on vital aspects of the State's economy and character. If the rate of emissions is lowered; however, projections show that many of the changes will be far less dramatic.

- Global climate change is having regional impacts on Vermont forests and birds. Though implications for individual species can appear benign, potential disruptions

Table 13: Identified Climate Change Trends

Climate changes in Vermont	Impacts on Forests
Longer growing seasons.	Changes in forest type and plant species distribution. Spruce fir forests are being replaced by hardwoods at high elevations. At lower elevations, oak-pine forests will likely replace forests dominated by sugar maple and other northern hardwoods.
More frequent winter thaws and earlier springs.	
Less winter precipitation falling as snow and more as rain.	
Increased heavy downpours.	Increased spread of forest pests, such as hemlock wooly adelgid, that can survive milder winters and take advantage of stressed trees. Non-native invasive plants may also spread. Hardwoods may be more susceptible to leaf diseases such as anthracnose.
Earlier spring snowmelt resulting in earlier peak river flows.	
More frequent short-term droughts in late summer and fall.	Forest based economy will be impacted by changes in timing and extent of peak fall foliage, shortened winter logging season stresses on maple in sugarbushes and reduced snowfall for winter recreation.
More frequent hot (over 90° F), humid days.	

Source: Climate Change and Vermont's Forests, Vermont Agency of Natural Resources Climate Change Adaptation White Paper Series (2011).

of complex ecosystem connections and process are far-reaching and serious for forests, birds, other wildlife and people. Particular identified trends are as follows:

- The Northeast is projected to see a 10% increase (about four inches per year) in annual precipitation by the end of the century. Winter precipitation is expected to increase by 20% to 30%, but because of a prediction in temperatures, more and more of this precipitation is going to fall as rain.

- Rainfall is expected to be more intense and heavy rainfall is expected to be more frequent, resulting in adverse effects to water quality and outbreaks of waterborne disease, replenishment of groundwater supplies, soil erosion and flood risks both in urban areas and agricultural fields in the Northeast.

KEY CHALLENGES AND TRENDS

Water Resources

Polluted Stormwater Runoff. Pollutants ending up in our waterways via stormwater runoff are an issue that not only affects local environmental and economic health, but also has federal implications in the Winooski River basin related to the Clean Water Act due to pollutant levels in Lake Champlain. The Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) requires that Federal, State and local partners use a comprehensive approach to reducing pollution in the Lake. Strategies that incorporate public education and outreach and require collaboration across public and private sectors will be critical in addressing these issues. These efforts include increasing inspections and compliance efforts for farms and related stormwater control practices, increasing technical assistance in designing rural roads to reduce erosion and sedimentation, increasing the stability of our streambanks, and assisting municipalities in encouraging stormwater control practices in those projects that fall below the State permit threshold. Adopting local stormwater policies also relates to flood resilience as it can help to slow stormwater runoff, spread it out over a larger area, and allow it to sink into the ground rather than immediately flowing into nearby streams and rivers, causing them to rise more rapidly.

Wastewater Treatment. Though we do not have a Region-wide assessment, localized studies point to findings of pollutant sources related to public and individual wastewater treatment systems that continue to impair surface and ground water quality. Water quality reports cite failing or inefficient septic systems that have infiltrated stormwater systems or discharged into nearby waterways. Development of small-scale community septic systems may be a solution to replace failing systems in the long term. Combined sewers, in which domestic sewage and stormwater are transported via the same pipe system to a waste water treatment plant, are another factor as they were designed with overflow points that keep the treatment plant from becoming overloaded during heavy rain storms. Combined sewer overflow remains an issue in some of the Region's larger communities, while some smaller communities are also having issues with storm water infiltrating wastewater systems during large rain events and discharging into local waterways.

Flood Resilience & Climate Change

Floodplain and River Corridor Encroachment. Historic settlement patterns near waterways have placed many of the Region's residences, businesses and valuable pieces of public infrastructure in areas prone to flood hazards. Some of the Region's communities have taken steps to place limits on investment in flood prone areas that exceed the National Flood Insurance Program minimum requirements. Development continues to occur in these areas in other communities, however, as access to main transportation corridors or the presence of downtowns, village centers or previously built-up areas make these floodplains and river corridors desirable for continued development despite the risks.

It will be important to mitigate flood risk through both prohibition of new structures and other significant investment, where feasible, or through more stringent requirements for site and building design that will not increase flood hazards where development must occur. Setting conservation priorities to permanently protect undeveloped areas that provide key flood storage functions

will also be important in planning for flood resilience.

River and Stream Barriers. Undersized and poorly designed culverts and bridges, particularly smaller pipe culverts, cause streams to dam and hold back sediment. This sediment can lead to clogging of culverts, sending water over the top of the road during a large rain event. There are also many older dams that no longer serve a useful purpose and are falling into disrepair. These dams disrupt river and stream equilibrium, create safety hazards and raise the potential for downstream ecological impacts in the event of failure. Inventories of these structures do exist, but more work is needed. Removal of barriers or mitigation of their impacts will be key in addressing the problem.

Outreach and Education. Planning and implementation to improve the Region's resilience to future flood events is a process that must involve a diverse range of public and private stakeholders as well as community leaders and engaged residents. Local government, State agencies, property owners, business owners, residents, builders, real estate agents, surveyors, etc. all have a role to play in advancing goals of reducing future flood losses. Outreach and education will need to be a key component in order to engage these populations, to seek input on areas or populations prone to flood hazards, and in raising awareness of flood risks and available resources and strategies to reduce risks.

Improved Documentation of Flood Extent and Damages. Damages can and do occur beyond mapped flood hazard areas and steps taken following a disaster to document the flood extent, eroded areas and resulting damages can be vital in mapping and mitigating potential future hazards. Federal grant programs that dedicate funds to local projects that will reduce damage and loss of property from flood events in the long term require that past damages be documented and quantified. In order continue to access funding for these types of projects, such as an up-sized culvert to accommodate larger storms or efforts to floodproof a business, it will be important to set up systems that facilitate the collection and documentation of this information, particularly for smaller-scale flood events whose damages aren't documented via FEMA assessment.

Climate Change Impacts on Natural Resources and Tourism. The Vermont Climate Assessment (2014) predicts that springs will continue to arrive earlier, summers will continue to grow hotter, and winters will become warmer. While winter storms are predicted to be fewer, they are slated to be more powerful as warmer air moving into the northeast from other regions can hold more moisture. Projected vulnerabilities within the Vermont landscape to these changes include a decrease in water and air quality as forests are impacted, an increase in precipitation and flood events, and a decrease in tourism due to impacts on fall foliage and winter recreation. It will be important to both take action to adapt to its potential impacts in order to maintain environmental health and community and economic vitality and to reduce the emissions serving as contributors to climate change.

Forests, Agricultural Lands & Wildlife Habitat

Maintaining Connectivity and Viable Working Landscapes. Inventories, mapping, prioritization and conservation strategies will be vital to reducing fragmentation, maintaining ecological linkages and maintaining healthy ecosystems and wildlife habitat. Similar strategies support important efforts to protect working forests and to keep productive land in agriculture. It will be important to work with state agencies and conservation organizations conducting inventories and mapping and with willing landowners interested in conserving their properties and preserving fragile and unique habitats. Equally important will be continuing to support municipalities in developing habitat, forest and agricultural-based protection priorities and in identifying regulatory and non-regulatory actions to make progress towards these goals. Maintaining habitat connectivity and large forest blocks is also a climate change adaptation strategy in allowing fish and wildlife to move, and can serve as the Region's best "insurance policy" in mitigating its impacts on environmental health.

Environmental Education. There is a need for continued and enhanced environmental education offered in the Region to strive for a broader public understanding. A more comprehensive understanding of complex environmental issues and the connections between economic prosperity, community vitality, and environmental health will benefit greatly future land use planning and decision-making. State-wide, community and school-based learning opportunities, such as using the forest as a classroom, are all vital to this effort.

Outdoor Recreation & Scenic Resources

Increase in Trail Usage The 2014-2018 State Comprehensive Outdoor Recreation Plan made note of an increase in membership in almost all trail-based organizations in the State, many of which are based here in Central Vermont. Increases in mountain biking and ATV riding organization membership were specifically highlighted. According to data presented, demand for outdoor recreation in Vermont is highest for road and trail-based activities (walking, skiing/backcountry skiing, sightseeing/driving for pleasure, hiking, snowshoeing, and bicycling). This increase in uses may underscore the need for continued and expanded educational efforts on low-impact recreation principles (i.e. Leave No Trace), respecting public and private property and trail etiquette.

Coordinated Outdoor Recreation Planning and Promotion. Central Vermont has a wealth of both commercial and public outdoor recreation assets including hiking, mountain biking, road cycling, hunting, fishing, skiing, boating and disc golf scattered throughout the Region. There is opportunity for both a more coordinated approach to recreation planning that could increase connections between the various trails, recreational areas and communities and for more coordinated marketing of these assets that provides a one-stop web resource with accompanying publications and makes Regional information more readily available to visitors and residents.

Conflicting Uses for Public Lands. Public recreational areas and trails are under increasing pressure to serve more needs and uses as preferences shift or certain types of recreation gain new popularity. A few examples include simultaneous use of a trail by hikers and mountain-bikers which can create certain safety hazards or that some uses may require higher levels of ongoing trail maintenance than others. For those visitors or residents who take to trails seeking remoteness in nature or solitude, encounters with motorized uses may

degrade the quality of the user experience. Limited budgets, limited amounts of land and the growing number of users present challenges in satisfying all user groups. However, these increases in demand present a need for increased involvement of more user groups in the long-range planning processes for these public land units to balance environmental, economic and social considerations and for additional management strategies to mitigate conflicts.

Incremental Rural Development and Infrastructure Siting. Broader development patterns and types occurring in the Region and other factors that are impacting scenic resources and aesthetic values include: scattered rural residential development, climate change, and related impacts on forests (including foliage impacts). Maintenance of designated scenic viewing areas is another consideration as vegetation in the foreground can overgrow designated vistas and mask panoramic views. The proliferation of telecommunication towers on hilltops and ridgelines underscores the need to balance broadband expansion with scenic preservation goals. Development of commercial-scale solar arrays or wind farms bring similar considerations. Implementation of siting and design guidelines for this infrastructure, as well as discussions regarding what significant local resources deserve extra protection or aesthetic consideration are both important next steps in addressing these issues.